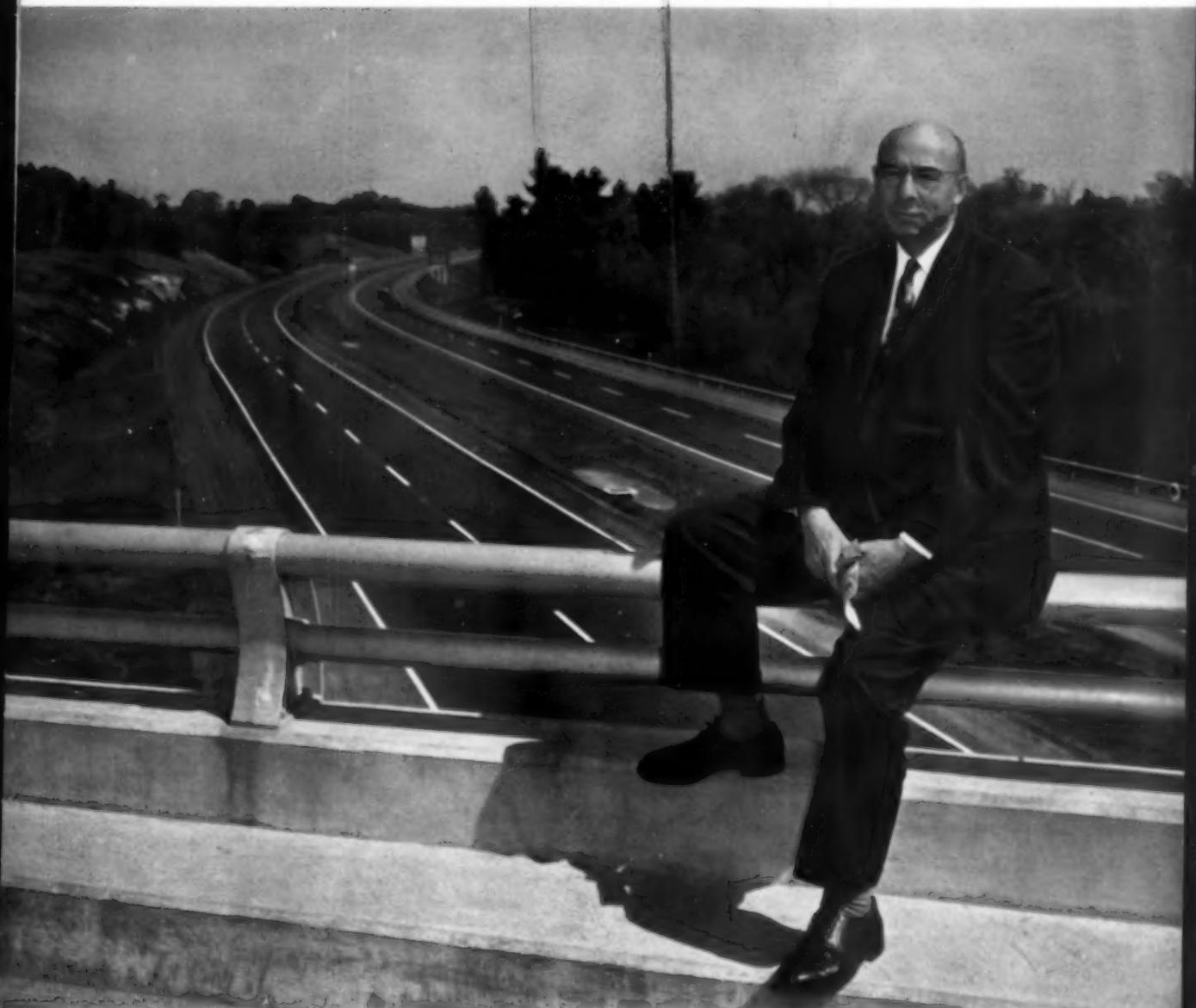


PUBLIC WORKS

City, County and State

August, 1961



David H. Stevens, Chairman of the Maine State Highway Commission, pauses on one of the structures crossing Interstate Route 95 near Augusta. He helped in the formulation of the national highway program as past president of the American Association of State Highway Officials. More on page 18.



PERMANENT CAST IRON PIPE

*Has Saved
Many Millions for
American Communities*

1847 BOSTON, MASS.
Water Main

1836 LANCASTER, PA.
12" Water Main

1834 READING, PA.
4" Water Main

1830 PHILADELPHIA, PA.
6" Water Main

1858 NEW ORLEANS, LA.
4" Gas Main

1834 POTTSVILLE, PA.
Water Main

1831 RICHMOND, VA.
8" Water Main

CAST IRON PIPE has earned its reputation as "Public Tax Saver No. 1" by saving replacement of mains which would have been necessary if shorter lived substitute pipe had been used.

Chief reasons why Cast Iron Pipe is "Public Tax Saver No. 1" are these:

Its Century or More of Useful Life. The proved useful life of Cast Iron Pipe is at least double the estimated life of other pipe materials used for underground mains.

Low Maintenance Cost . . . far below that of any other pipe material that has been in use long enough for the recording of conclusive data. This is because of its effective resistance to corrosion by oxidation and its wide margin of safety in strength to withstand impact, beam and crushing stresses.

Re-Use or Salvage Value. Because it can be taken up and relocated, Cast Iron Pipe serves out its full useful life in its original location or elsewhere.

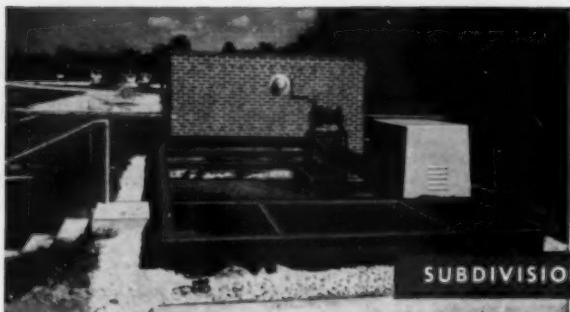
If your community expects to grow, the time is now to plan ahead for enlarged Cast Iron water mains and sewers that will provide efficient and dependable service for a century or more at lowest maintenance cost.

This advertisement is published
in the interests of the
Cast Iron Pressure Pipe Industry
by . . .



WOODWARD IRON COMPANY

WOODWARD, ALABAMA



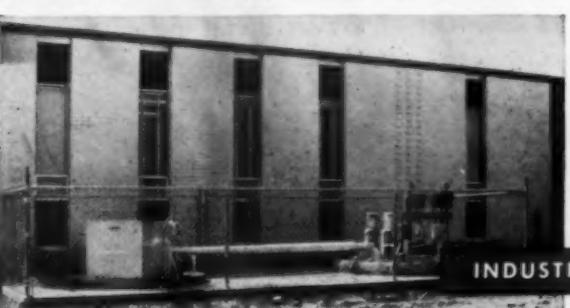
RAMS . . . Indianapolis, Indiana . . . RatedAeration, medium steel sewage treatment plant for design flows to 15,000 GPD. Factory fabricated with "Chicago" standardized balanced equipment. Engineer—
Curtis & Davis. Ask for Bulletin 135-A.



RALC . . . Vacaville, California . . . Large concrete RatedAeration plant using "Chicago" sewage equipment throughout for more effective treatment. Capacities from 60,000 GPD. Engineer—
M. Carlton Yoder. Ask for Bulletin 135-A.



RAMC . . . Hialeah, Florida . . . Above ground installation of a medium concrete treatment plant. Packaged standardized, balanced equipment for flows from 7,500 to 60,000 GPD. Engineer—
Loyd Frank Vann Associates. Ask for Bulletin 135-A.



RASS . . . Metairie, Louisiana . . . Small steel, circular factory fabricated sewage treatment plant for communities from 10 to 500 people available in 1, 3, & 5,000 GPD capacities. Engineer—
Curtis & Davis. Ask for Bulletin 136.

"from
Chicago"

**RATEDAERATION
SEWAGE TREATMENT
EQUIPMENT FOR
EVERY FRINGE AREA
SEWAGE NEED**

**Odor free, nuisance free,
low cost, small package
steel or large concrete plants
. . . 1,000 to 1,000,000 GPD**

Whether steel or concrete units, all RATEDAERATION systems obtain the same degree of high treatment through aeration. Proved successful in more than 950 installations, RATEDAERATION units are always economically expandable for area planning of future sewage systems.

There is a small packaged RATEDAERATION unit specifically designed to provide any fringe area with reliable, continuous sewage treatment at low original cost . . . and with low operating expense.

For further information call your local Chicago Pump distributor or write Chicago Pump for bulletins listed above.



© 1961—CP-FMC

Putting Ideas to Work

FOOD MACHINERY AND CHEMICAL CORPORATION

HYDRODYNAMICS DIVISION

CHICAGO PUMP

622 F DIVERSEY PARKWAY • CHICAGO 14, ILLINOIS

Special report to users of Caterpillar equipment



New Cat parts stretch dollars “down where the digging’s going on”

That's more than just talk! More and more users are conducting their own field trials of ground engaging tools—tips, bits, teeth and edges—to determine which brand gives them the best performance-cost balance. And time after time, they find that genuine Caterpillar ground engaging tools outclass

all comers—in production and over-all economy!

Take Cat cutting edges. These edges have been contractor-tested with most of the market's leading brands all over the country. Results: Cat edge wear life—10-60% longer. Cat edge cost—15-50% less per hour. Think of that in terms of dollars!

HERE'S A LOOK AT RECENT FIELD TRIALS ON SCRAPER CUTTING EDGES:

Two DW21-470 Scrapers, one with Cat *standard* edges and one with popular brand *thick* edges, were put to work “side-by-side” by a contractor in hard, red clay on an Interstate Highway job. His findings:

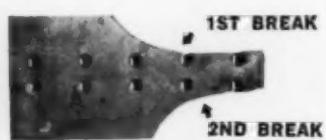
Brand	Price	Hours of Life	Cost per Hour
Other	\$121.22	1060	\$114
Cat	\$128.28*	1360	\$0.94

HIS SAVINGS WITH CAT EDGES — 17.5% PER OPERATING HOUR

*Test completed before recent new low price of \$102.30 effective.



CATERPILLAR



OTHER BRAND

A Cat $\frac{7}{8}$ " stinger and another brand *one inch thick* were split in half and a section from each installed on same DW21-470 Scraper working in decomposed lava with embedded basaltic boulders. Other brand section broke after 48 operating hours, was reversed but broke again two hours later—a total of 50 hours of life. *Cat edge wear during period was $\frac{1}{4}$ ", other brand $\frac{1}{2}$ ".*

Your Caterpillar Dealer has the facts on many of these tests—go over them with him and start to save more now.

Caterpillar continually up-dates its line of ground engaging tools. Some of the newcomers to the line that “stretch your dollars” are: new self-sharpening end bits and ripper tips, patented reversible router bits, and new-design scarifier teeth for Motor Graders. These new money-savers keep production high, costs down.

Caterpillar Tractor Co., General Offices, Peoria, Illinois, U. S. A.

CATERPILLAR

Caterpillar and Cat are Registered Trademarks of Caterpillar Tractor Co.

THE MOST USEFUL ENGINEERING MAGAZINE FOR CITIES, COUNTIES AND STATES

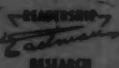
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PUBLIC WORKS JOURNAL CORP.
 200 So. Broad St., Ridgewood, N. J.

Link-Belt's creative answer to a critical sewage problem:

Complete, two-stage bio-filtration in one compact, low-cost unit

BIO-PAC

offers "Big City" sewage processing for the needs of 50 to 500 people

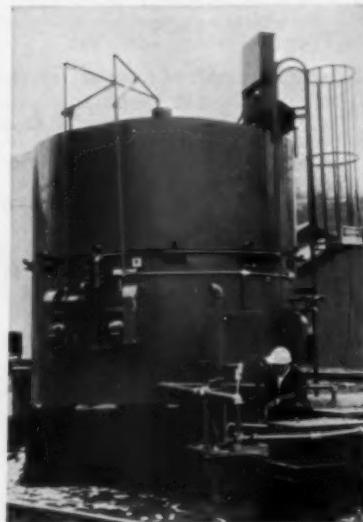
Link-Belt's Bio-Pac brings the economies and efficiencies of "big-city" bio-filtration sewage treatment to areas remote from metropolitan sewerage service. Single units are available to serve 50 to 500 people—perfect for housing developments, trailer courts, motels, shopping centers, industrial plants, schools and institutions.

Bio-Pac literally gives you a functional scaling down of large-volume sewage-plant concepts. Yet, the

"scaled-down" design is a matter of size only . . . no compromise of quality! Each unit is a highly efficient, two-stage bio-filtration system . . . built to meet the Ten State Standards for sewage works.

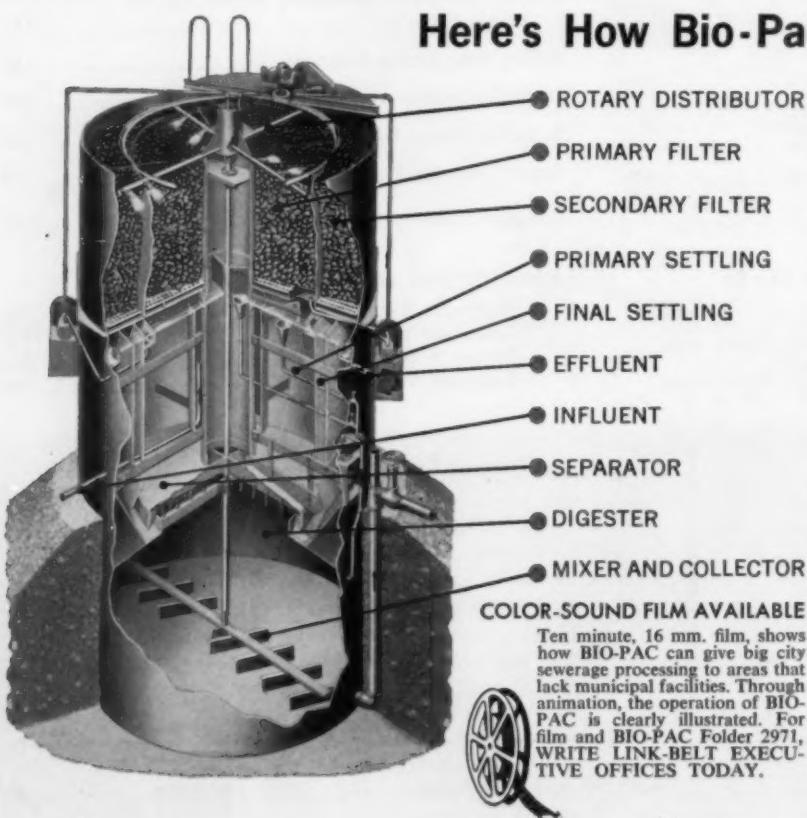
Even under adverse conditions, Bio-Pac produces a consistently stable effluent. It readily absorbs shock loads which frequently upset aeration-type units. And power requirements are much lower than for aerated systems. Important too, Bio-Pac is entirely automatic. Only part-time care is required . . . by personnel who needn't be highly trained.

Because of its exceptional compactness, Bio-Pac can be easily concealed through landscaping and other techniques commonly used in connection with electric service and water storage facilities.



BIO-PAC SEWAGE Treatment Plant for 18,000 G.P.D. flow of sanitary waste. Installed at Houdaille Construction Material Co., Bridgeport Twp., near Bound Brook, New Jersey Plant.

Here's How Bio-Pac Works



Ten minute, 16 mm. film, shows how BIO-PAC can give big city sewerage processing to areas that lack municipal facilities. Through animation, the operation of BIO-PAC is clearly illustrated. For film and BIO-PAC Folder 2971, WRITE LINK-BELT EXECUTIVE OFFICES TODAY.

Bio-Pac two-stage treatment starts with removal of the settleable solids in a primary settling compartment. Then, sewage is pumped to two bio-filters operating in series, where aerobic bacteria remove 85 to 95% of the suspended solids and B.O.D. (Biochemical Oxygen Demand). The last stage, a final settling compartment, completes the process of producing a stable effluent.

Sludge from both primary and final settling compartments goes into the digester. Disposal of digested sludge can be done on drying beds or by tank truck haul-away about once or twice a year.

LINK-BELT

SANITARY ENGINEERING EQUIPMENT

LINK-BELT COMPANY: Executive Offices, Prudential Plaza, Chicago 1. Sanitary Engineering Regional Office—Atlanta, Chicago 9, Colmar, Pa., Kansas City 8, Mo., San Francisco 24. District Sales Offices in All Principal Cities. Export Office, New York 7. Representatives Throughout the World. 10,000



Winter Is Coming Again

SNOW REMOVAL, including ice control, has so proved itself as an economic necessity and a safety measure that there can be no argument regarding it. The need for prompt and effective action becomes more imperative each year as more and more motorists travel to and from their work. Work-travel distance will surely increase as the Interstate system is opened to traffic; and there has to be an adit and an exit for every Interstate traveler, so the burden on city, county and township agencies will also increase.

For the coming winter, now is the time to begin to get ready. This means a review of available equipment, the replacement of worn out items and the additions necessary to meet future needs; it also means checking the organization that served last winter and setting up the necessary training programs for the coming year; and finally it means liaison and coordination with other agencies.

Keeping winter highways open is a big job and an important one that will become bigger and more important each year. It is worth—and, in fact, it demands—the best in equipment and in management skills. Both are available and both should be used unsparingly.

What Will It Do for the User?

IN THIS DAY and age equipment that will do the work faster, cheaper and perhaps better is vitally necessary in every segment of the public works industry. To help in spreading the knowledge about this useful equipment (and materials) we publish in two sections of PUBLIC WORKS each month information on such products.

For some items as many as two hundred or even more inquiries are received; for others only a half-dozen. The difference usually lies in the information, or lack of it, that the manufacturer incorporated into his releases and his literature. A few of these are excellent; the majority are mediocre; the others downright poor. It seems seldom to occur to many or most of the writers of these releases to tell what the equipment or material will do for the user, how it will save money or how it will speed up work. Instead it sounds as though some shop foreman, mechanical engineer or test man tells mostly how many bolts are used, what size they are and that

they have such important characteristics as square shoulders.

A delegation of responsibility for writing most releases (and many of the catalogs) to a sales engineer who knew his business and what he was trying to sell might increase greatly the returns from such publicity and let a lot of other folks go back to their nuts and bolts.

Employment, Transportation and Urban Renewal

DESPITE the much talked of shift of industry out of the big cities, it is certain that employment in them will continue to rise during the coming years. That is, the increase in jobs due to expansion in existing industrial sections in the big cities will more than offset the movement of other plants to the suburbs. This will set in motion a chain of events.

As jobs increase, traffic will also increase and much or most of this will be vehicular. Expressways to carry this traffic will use up considerable land area. To permit industrial expansion more land will be needed within the central city area. This can come only from presently inadequately utilized areas—that is slum and other run-down sections. Here is where urban renewal enters the picture as a possible solution to problems in many cities, even in some that cannot be termed big cities. Urban renewal is a place where the skills of the trained public works engineer are essential; any program that does not utilize these skills is likely to be inadequate.

A Possible Preview of Future Pipe Line Problems

IN LAYING 73 miles of gas line in the Chicago area, crossings were a problem. There were 72 highways to be crossed, some of them 4-lane divided; 28 rivers, large and small; and 11 railroads. The railroads and highways were crossed by boring and placing casing pipe. Since the line was 30 ins. in diameter, the problems were somewhat different than those involved in smaller water and sewer lines. However, this experience does provide a preview for the future and emphasizes the need for a wider knowledge and use of earth boring equipment, of subsoils and of the composition of some of our highway fills.



Assurance of continuity of service

Cement-lined cast iron pipe always delivers a full flow of water and rarely requires repair. These two features alone offer ample assurance of water when you most need it. But there are other reasons also:

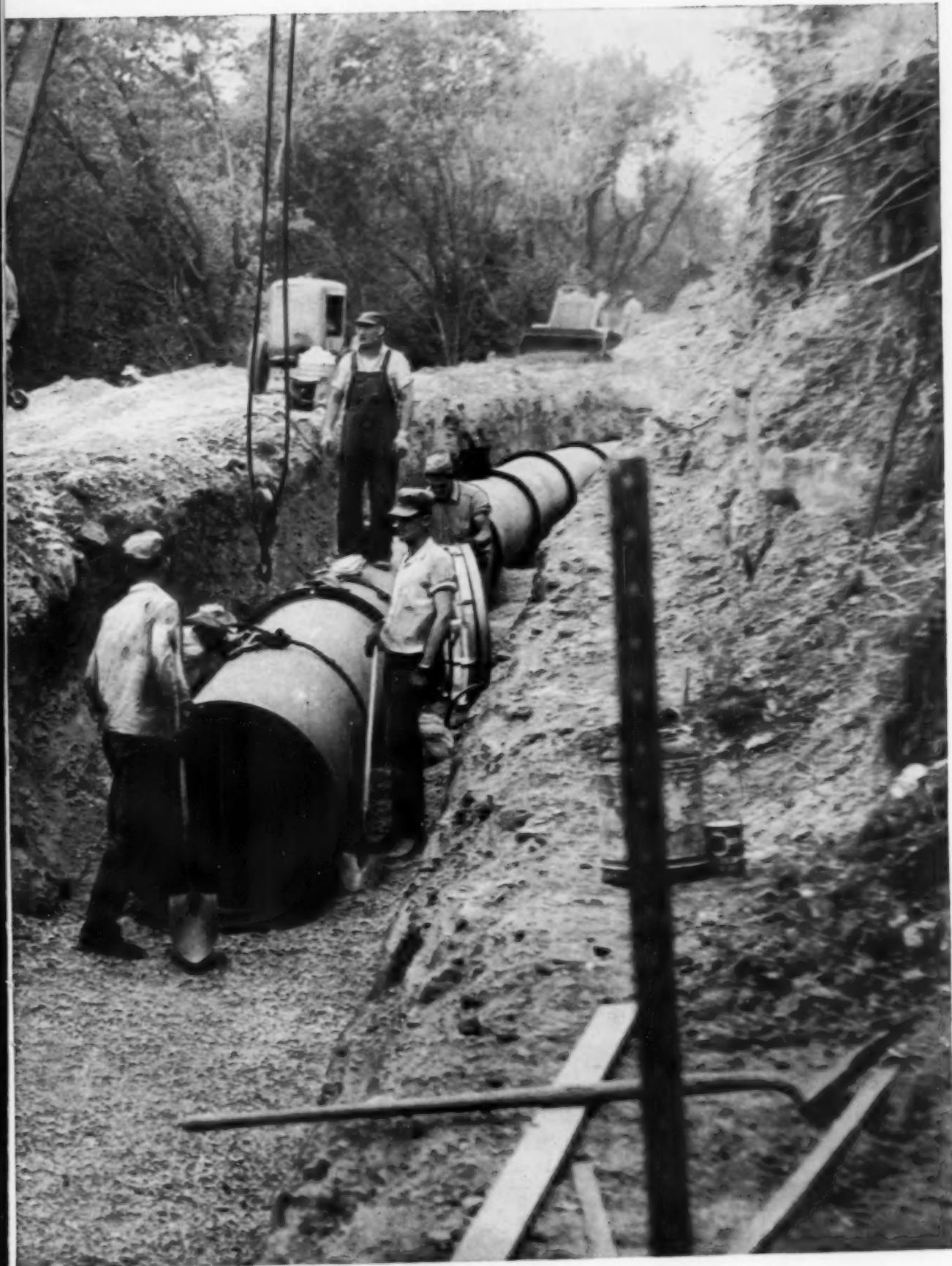
Cast iron pipe is flexible enough to permit deflection, both during and after installation; yet, its bottle-tight joints are tight enough to resist hundreds of pounds of pressure.

Rugged cast iron pipe withstands common disturbances such as overhead traffic, ground movement and water hammer; it installs easily; it performs efficiently day after day . . . and will continue to do so for over a century.

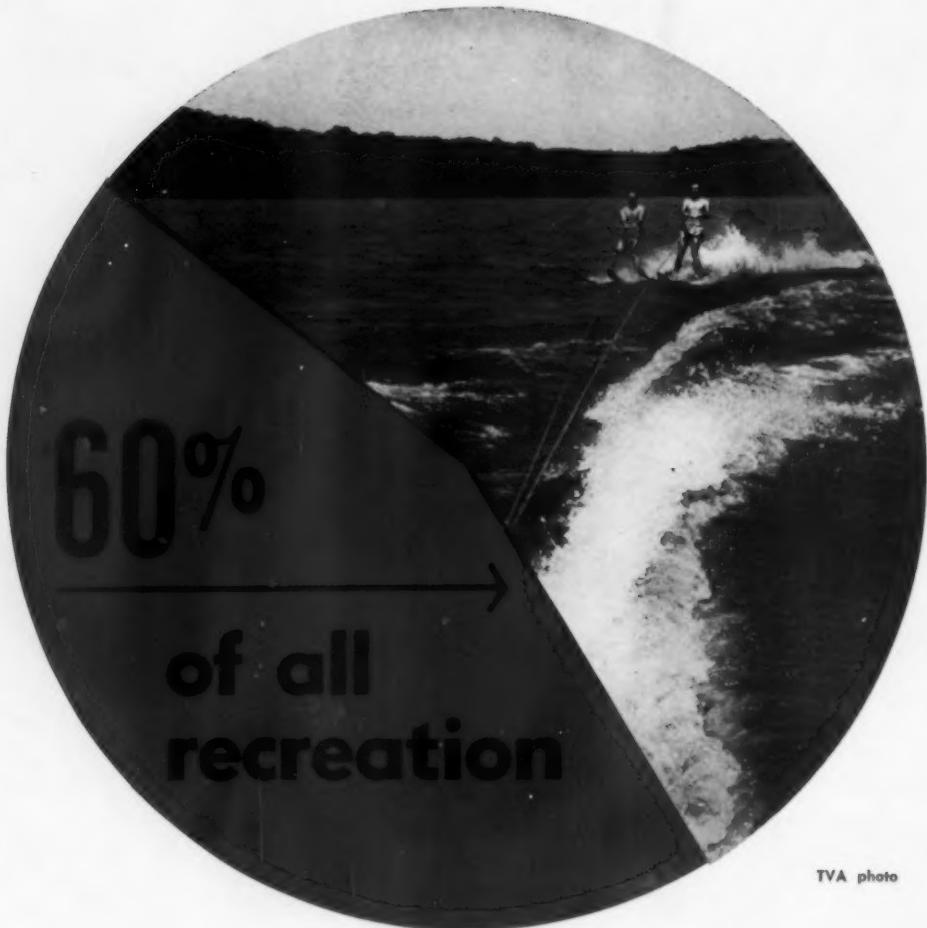


CAST IRON PIPE
THE MARK OF PIPE THAT LASTS OVER 100 YEARS

CAST IRON PIPE RESEARCH ASSOCIATION
Thos. F. Wolfe, Managing Director
3440 Prudential Plaza, Chicago 1, Illinois



PUBLIC WORKS for August, 1961



TVA photo

is water-oriented...

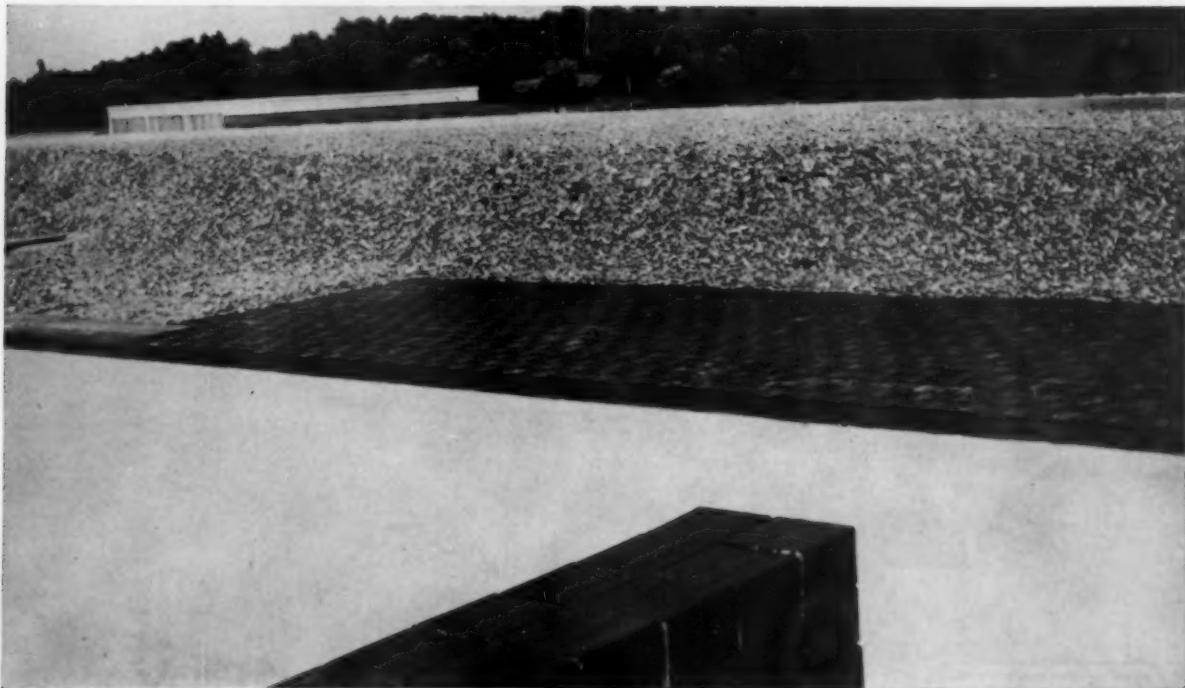
for this clean waters are a necessity

Recreation is big business. Boating, bathing, fishing, water skiing all bring tremendous sums to the far-sighted areas that cater to them by providing clean waters.

The simplest, surest way to insure them in the average community is to build trickling filters for sewage and industrial waste treatment plants. These filters offer economy and efficiency in construction and operation, long trouble-free life, and can most easily be added to if growth exceeds original estimates.

TFFI

TFFI Specification vitrified clay floor blocks in one of four 200-foot trickling filters at Winston-Salem, N.C.
Consulting Engineers, Piatt & Davis, Durham, N.C.
General Contractor, Lee Construction Company, Charlotte, N.C.

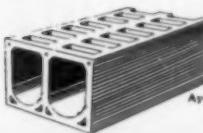


The best trickling filters

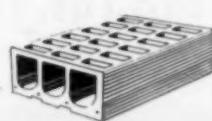
Use vitrified clay underdrain blocks. Clay stands alone in its resistance to every ordinary corrosive factor. TFFI Specification blocks also stand alone in being made right—in modern plants under manufacturing controls of quality that substitute materials cannot possibly meet. Only TFFI members offer a 50-Year Guarantee of their blocks.

Demand CERTIFIED Underdrain Blocks

Vitrified clay block manufactured by TFFI members and tested by the Materials Testing Laboratory of Rose Polytechnic Institute comply with or exceed ASTM Specification C 159-59T. For a copy of these Specifications, see your TFFI Handbook or write nearest member for one.



ARMCRS
Ayer-McCarel Clay Co., Inc.
Brazil, Ind.

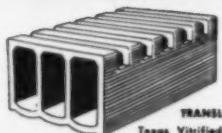


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P.O. Box 2028
Kansas City 42, Mo.



TRANSLOT
Connellon Sewer Pipe Co.
Connellon, Indiana

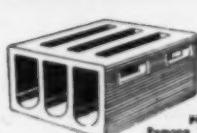
Trickling Filter Floor Institute



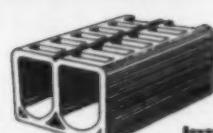
TRANSLOT
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Mineral Wells, Texas



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POMONE
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Greensboro, No. Car.



BOSCO
Sewerage Shale Co.
Beverston, Ohio



Two mighty snow movers for your Galion Grader!

You move mountains of snow, cut drifts down to size with a Snow Plow and Wing. Made in sizes to fit any Galion Grader, these sturdy attachments let you clear more miles of road every working hour.

"V" type Plow is constructed and braced for heavy-duty service—designed to slice through the deepest snow. Renewable cutting edge is high carbon steel. Sliding shoes (with renewable wearing plates) keep Plow from digging into road.

Use the Galion Snow Wing to clear road shoulders, cut down high drifts. It adjusts up to four feet from ground level at an angle of 45°, providing a cutting height of eight feet.

Both Plow and Wing are hydraulically controlled from the cab. Independent operation means less work

for the man in the cab . . . fast and accurate adjustment of Plow and Wing.



*See your Galion distributor
or write for descriptive
bulletin.*

THE GALION IRON WORKS & MFG. COMPANY, Galion, Ohio, U.S.A.
General and Export Offices, Galion, O., U.S.A., Cable Address, GALIONIRON, Galion, O.



IF WATER IS YOUR BUSINESS...

YOU CAN PICK THE
AMERICAN
METER

THAT MEETS YOUR SPECIFIC NEEDS

Water Characteristics are not the same everywhere. Mineral and chemical contents vary. Their reaction on the measurement instruments that guard your profits can cause you trouble and expense.

That's why AMERICAN offers you the most complete design flexibility of any meter and lets you pick the elements that meet your specific needs.

Only AMERICAN Offers a Choice of:

- Sealed or Standard Register Box
- 3 Piece or 1 Piece Measuring Disc
- Oil-Enclosed or Chrome Shell Gear Train
- Reinforced or Thrust-Roller Disc Insert
- Bronze or Nickel Alloy Measuring Chamber
- Frost Bottom of Breakable Bronze or Galvanized Cast Iron
- 3 Housing Styles — Frost-Bottom, Split Case or Solid Case Construction

You select the elements to fit your needs — if you like, our engineers will help. In addition, each AMERICAN water meter provides you with the basic built-in features of unmatched construction simplicity, unequalled measuring accuracy, uniform precisely machined parts and assemblies, and the widest range of interchangeability.

AMERICAN meters are designed to last longer, and save you money — when you buy 'em, when you run 'em and when you repair 'em. Why not try them and see for yourself.

For complete details write for Bulletin 58

BUFFALO METER COMPANY, INC.

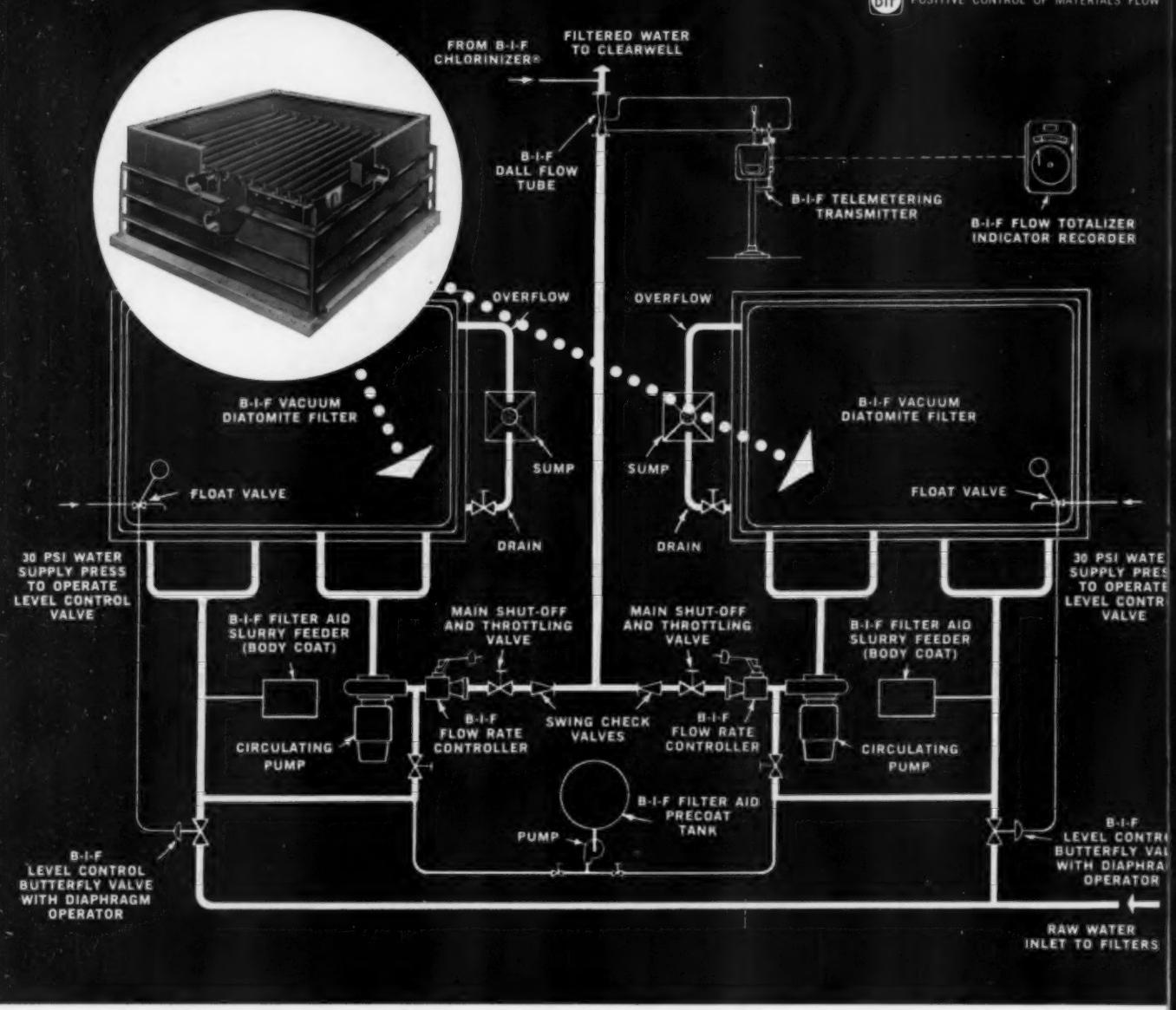
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POSITIVE CONTROL OF MATERIALS FLOW



New **B-I-F** low cost filtration system meets peak load demands!

You no longer need high cost expansion to meet peak load demands. At a fraction of the cost formerly required, B-I-F can provide a completely integrated filtration and treatment system. The low installation, operational and maintenance costs save thousands of taxpayers' dollars.

This B-I-F system is built around low cost, performance proven Vacuum Diatomite Filters. The filters' open tank design permits simple visual operation . . . and easier inspection and accessibility. Fiberglass construction eliminates annual painting and repair of protective linings. Chemical pre-treatment is simplified. Wash water requirements are minimized.

From its line of compatible components . . . filters, chem-

ical feeders, instrumentation, butterfly valves, etc. . . . B-I-F will provide a coordinated system to meet your specific peak load requirement. A B-I-F system requires minimum start-up time . . . assures maximum reliability, flexibility for further expansion, and dependable, single responsibility.

Write for the facts! B-I-F Industries, Inc., 356 Harris Ave., Providence 1, Rhode Island.

B-I-F **Industries**
BUILDERS • PROVIDENCE • PROPORTIONERS • OMEGA
METERS • FEEDERS • CONTROLS / CONTINUOUS PROCESS ENGINEERING

KEEP STORM WATER INSIDE THE PIPE



with

TYLOX® Rubber GASKETS

Even under flood pressure, *compression-tight* TYLOX Gaskets won't let storm water force past to undermine the land . . . a major reason why TYLOX was selected for coupling this 36" diameter concrete storm drain for the City of Margate, New Jersey. The project was engineered by E. Lester Kiger, Margate City Engineer. Pipe was manufactured by United States Concrete Pipe Co., Cleveland, Ohio, and installed by Delpatria Construction Co., Atlantic City, N. J.

If you are not already taking advantage of TYLOX to assure watertight, as well as acid-resistant, quickly-assembled joints for your projects, send for the TYLOX MANUAL. It contains engineering, installation and performance data on the full line of Hamilton Kent rubber or Neoprene Gaskets for coupling *any type* of concrete pipe. It shows *why* and *how* TYLOX does these three important jobs most efficiently.



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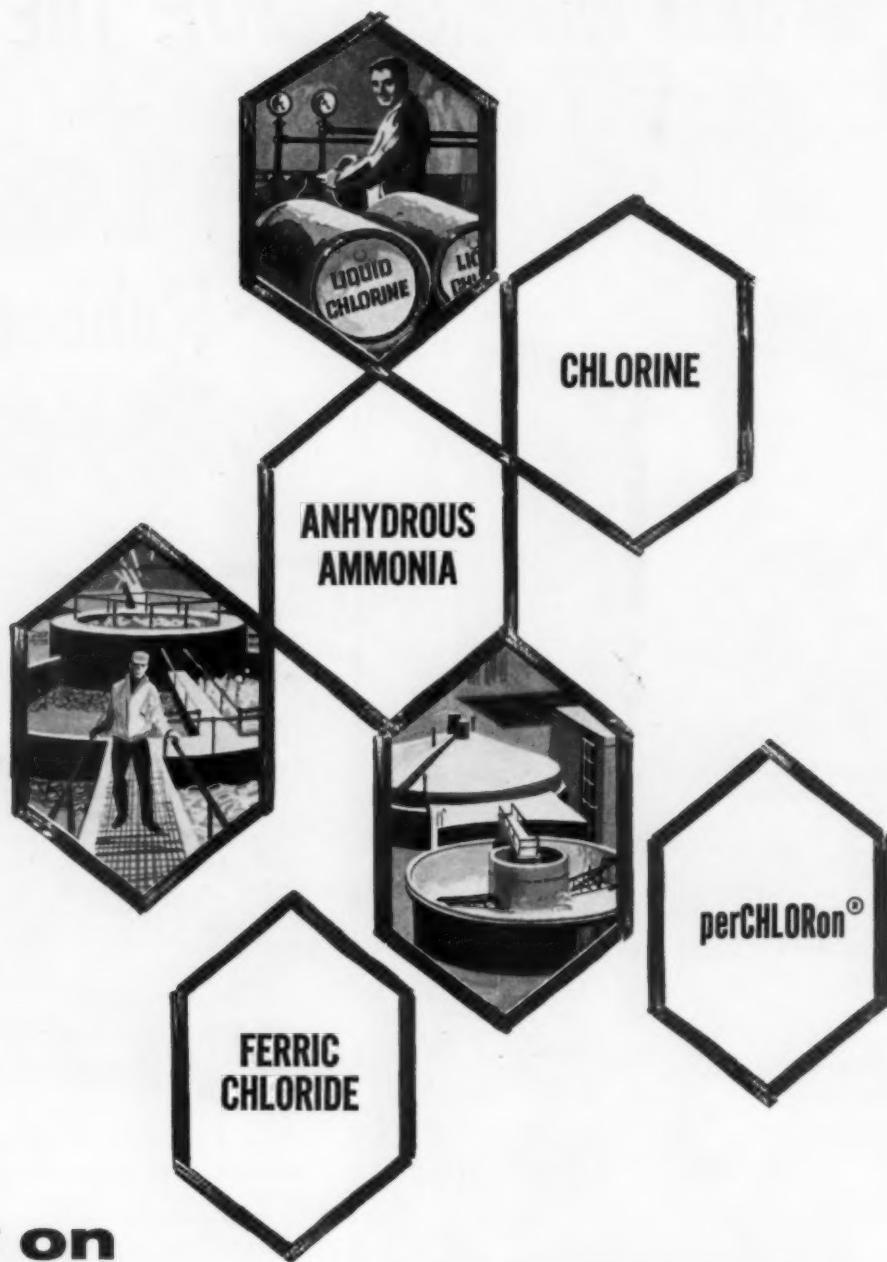
CANADA:

Cooksville, Ont., ATwater 9-3671

HAMILTON KENT
MANUFACTURING COMPANY

427 W. Grant St. • KENT, OHIO • ORchard 3-9555

5190



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FOR EFFECTIVE, EFFICIENT WATER AND SEWAGE TREATMENT

Whether your needs are a few cylinders and drums or multiple unit rail cars . . . you can be sure of dependable chemicals . . . and fast, reliable delivery every time.

And your needs for technical assistance can be supplied by Pennsalt's Technical Service engineers — "on your staff but not on your payroll" at no extra cost.



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3 PENN CENTER
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NEW YORK * PITTSBURGH * PORTLAND
ST. LOUIS * SALT LAKE CITY * SAN FRANCISCO



NOW! An ice control program that cuts accidents and complaints!

The Morton Safe-T-Salt* Ice Control Program can help you accomplish two important jobs this winter . . . public safety and public relations!

Streets are safer when they are salted with Safe-T-Salt, because it is a screened and graded rock salt that gets rid of dangerous ice and snow in the quickest, safest, most economical way possible.

The name "Safe-T-Salt" was developed to explain this job to the public. As you know, too many uninformed citizens complain about de-icing programs every winter. The "Safe-T-Salt" name will cut down those complaints by emphasizing the safety value of salting treacherous pavements . . . will keep the public aware of your efforts to reduce winter driving hazards.

The truck banner in the illustration above represents one way that safety salting can be made popular. These banners are available free to Morton Salt customers. Your Morton representative can supply them and other material . . . as well as furnishing you with helpful publicity features for your local newspapers, explaining the value of de-icing programs. He'll be glad to help you start planning now for a safer and happier winter.

FOR MORE INFORMATION ON MORTON SAFE-T-SALT, MAIL THIS COUPON TODAY

Please have a Morton Salt representative call me for an appointment to explain all the advantages of your Safe-T-Salt program.

Name _____

Title _____

Address _____

City _____ Zone _____ State _____

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COMPANY**

INDUSTRIAL DIVISION

Dept. PWB, 110 N. Wacker Drive, Chicago 6, Ill.

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You can use a McConnaughay Mixer to reactivate and heat stock pile mixtures... prepare cold asphaltic mixtures... prepare hot asphaltic mixtures... dry various types of wet aggregates quickly, thoroughly... remove both moisture and solvents from bituminous mixtures... produce bituminous mixtures with tars, paving asphalts, cut-back asphalts, and emulsified asphalts. McConnaughay Mixers operating under U. S. Patent No. 2,626,875, are authorized to mix emulsified asphalt and aggregates in the presence of flame and heated gases. Write for our folder on the complete line of McConnaughay Asphalt Patching Mixers as well as for specifications and proportioning tables.



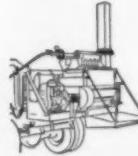
HTD MIXER No. 10
½ ton per batch



HTD MIXER No. 8
½ ton per batch



HTD MIXER No. 5
¼ ton per batch



HTD MIXER No. 4-T
½ ton per batch

McCONNAUGHAY MIXERS, INC.—LAFAYETTE, IND.

National distributors: Asphalt Equipment Co.

3314 Cherry Lane, Fort Wayne, Indiana

Export Representative: William H. Schuelie, 440 E. 79th St., New York 21, N.Y.

About the Cover

David H. Stevens, chairman of the Maine State Highway Commission and immediate past president of the American Association of State Highway Officials, is known in his home State as one of its ablest administrators. He has spent 27 of his 52 years in government service and the last seven as chairman of the Highway Commission. His first appointment put into effect a 1953 law, which made the chairmanship a full-time chief administrative position. This year he was appointed to a second seven-year term.

Stevens came to his present position from a 5-year stint as commissioner of Maine's Health and Welfare Department and prior to that served as the State's tax assessor and as the town manager of Ashland, Guilford and Milo. He was graduated from the University of Maine with a B.S. degree in civil engineering in 1928.

Besides being the past president of AASHO, Stevens is past president and member of the board of directors of the Association of Highway Officials of the North Atlantic States, chairman of the Maine-New Hampshire Interstate Bridge Authority, and a member of ASCE, Maine Association of Engineers, Maine Turnpike Authority and Maine Good Roads Association.

Stevens and his wife, the former Dora Wilson of Sangerville, have two daughters, both married and away from the family home in Hallowell. Stevens claims few interests outside of his job, although he will dip into a detective story now and again as a change from his steady diet of trade journals and reports. One of the things he likes to do most is ride along Maine's miles of scenic highways to see if the signs are straight and clear and the pavement unmarred by frost or other damage. Even on a Sunday excursion with his wife he is not above stopping the car to check the condition of a gravel shoulder or the capacity of a culvert.

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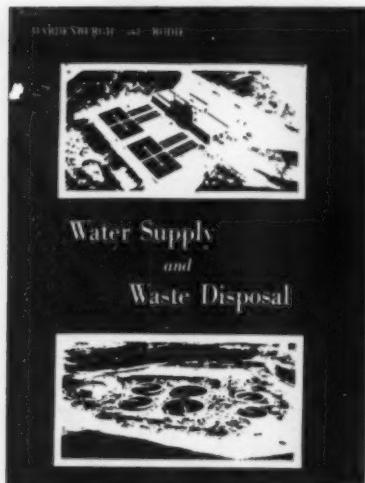
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PILE FOUNDATIONS

This is a presentation of the essential facts and data needed for economical and efficient design and handling of pile foundations. There is much practical information on theory, design, installation, maintenance and repair of pile foundations. Among the subjects covered are the methods of determining pile capacities from driving resistance and selecting piles and types of pile-driving equipment. The book describes and evaluates types of wood, concrete and steel piles and sheet piling, and gives methods for structural design of piles, preventing corrosion of steel piles, protecting concrete piles, and load testing. By R. D. Chellis, Stone & Webster; 683 pages; 246 illustrations, \$16. McGraw-Hill Book Co., 327 W. 41st St., New York 36, N. Y.

FUNDAMENTALS FOR PROFESSIONAL ENGINEERS' EXAMINATIONS

This text is intended to assist practicing engineers desiring to review their engineering preparatory to taking the closed-book portion of the state professional engineering examination. It covers all phases of engineering in concise detail, with particular emphasis on the eight different fields of engineering that ordinarily appear on the exams—mathematics, mechanics, fluid mechanics, thermodynamics, mechanics of materials, electricity and electronics, chemistry, and economics and investment theory. By L. M. Polentz; 360 pages; 327 illustrations; \$9.50; McGraw-Hill Book Co., New York 36, N. Y.

ASPHALT PAVING TECHNOLOGY

Volume 29 of the proceedings of the Association of Asphalt Paving Technologists, now available, includes papers on drying and heating aggregates; quality mix control; effects of fillers; wire reinforcement; testing methods; epoxies and other additives. The price is \$6.50 from the Association, Box 619, Ann Arbor, Mich.

CHALLENGE OF STREET LIGHTING

This is a reprint from the Kansas Government Journal of a series of articles on street lighting which appeared during a 4-month period last fall. The study reviews the existing situation and discusses planning, installing and operating an adequate and effective system. In effect, it is a guide to what is possible to obtain in respect to value and cost. There are 36 pages; the price is \$2 per copy. Order from the League of Kansas Municipalities, 112 West Seventh St., Topeka, Kans.

PRESTRESSED CONCRETE DESIGN & CONSTRUCTION

This text discusses basic concepts of prestressing and then presents a step-by-step development of flexure analysis along with expedients for saving both time and work of computation. Design data are presented for bridge and building structures; plant facilities, construction methods and equipment are discussed. By James R. Libby, consulting engineer; 468 pages; \$12.50. Ronald Press Co., 15 East 26th St., New York 10, N. Y.

FAILURE & REPAIR OF CONCRETE STRUCTURES

Chemical and mechanical failures of concrete are covered in the early chapters of this English book; methods of repair are then detailed. Examples are given of undesirable features in design and construction which are applicable to all concrete work. A chapter is included on floors; cracks and joints are dealt with, especially in respect to waterproofing. A final chapter covers repair supervision. By Stewart Champion; 200 pages; prices 35 shillings; Contractors Record, Ltd., Lennox House, Norfolk St., London WC2, England.

PRESTRESSED CONCRETE CYLINDRICAL TANKS

This English text covers planning, detail design, construction and servicing all types of prestressed cylindrical tanks. Detailed procedures for design are given, with simplified procedures for fully monolithic tanks with rigid joints where absolute watertightness is necessary. Repairs by pressure grouting are described. Simplified expressions are given for dome roof design with rapid correction factors for partial fixity at the junction of the dome and the supporting walls. By L. R. Creasy; 216 pages; 35 shillings; Contractors Record, Ltd., Lennox House, Norfolk St., London WC2, England.

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On all Allis-Chalmers tractor loaders dump cylinders are placed near the center of gravity, out of the dirt and grit that can score piston rods . . . damage entire hydraulic system.

Instead of mounting dump cylinders on the bucket, Allis-Chalmers puts them up and away from abrasives that can cause scoring of piston rods or get into vital hydraulic components and ruin the entire system. In addition, this dump cylinder location brings greater loader stability . . . no extra weight to lift with bucket . . . fewer moving parts.

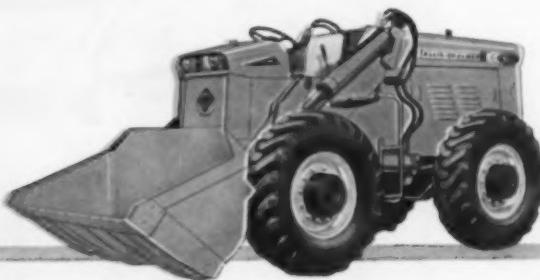
Other tractor loader advantages you'll like are: *Single lever speed and direction control; pin-connected axles that hold tight under load; extra stability from extra-long wheelbase; high lift—added reach for fast, even dumping even into sideroaded trucks; and 5-way hydraulic filtering protection that means less downtime . . . extended loader life.*

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Allis-Chalmers offers 6 tractor loader models—ranging in power from 76.5 to 184 horsepower—in carry capacity from 3,600 to 10,500 lb and with buckets available from 1 to 6 cu yd.

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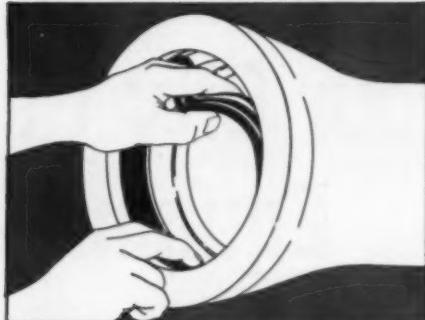


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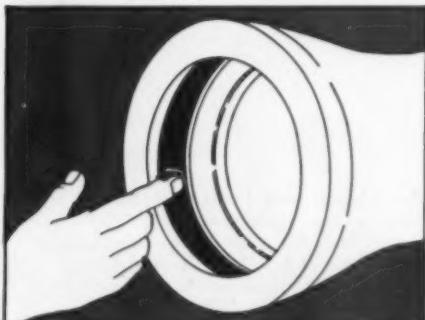
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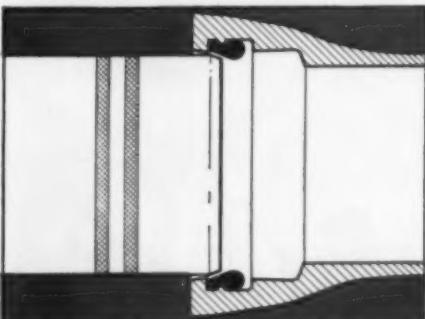
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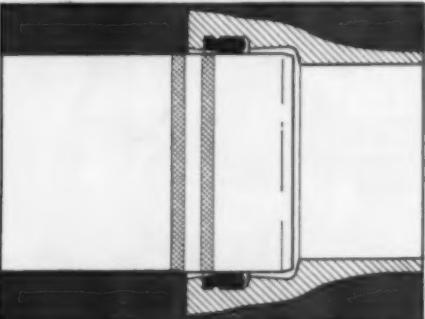
Insert gasket with groove over bead in gasket seat . . . a simple hand operation.



Wipe film of Tyton Joint® lubricant over inside of gasket. Your receiving pipe is ready.



Insert plain end of entering pipe until it touches gasket. Note two painted stripes on end.

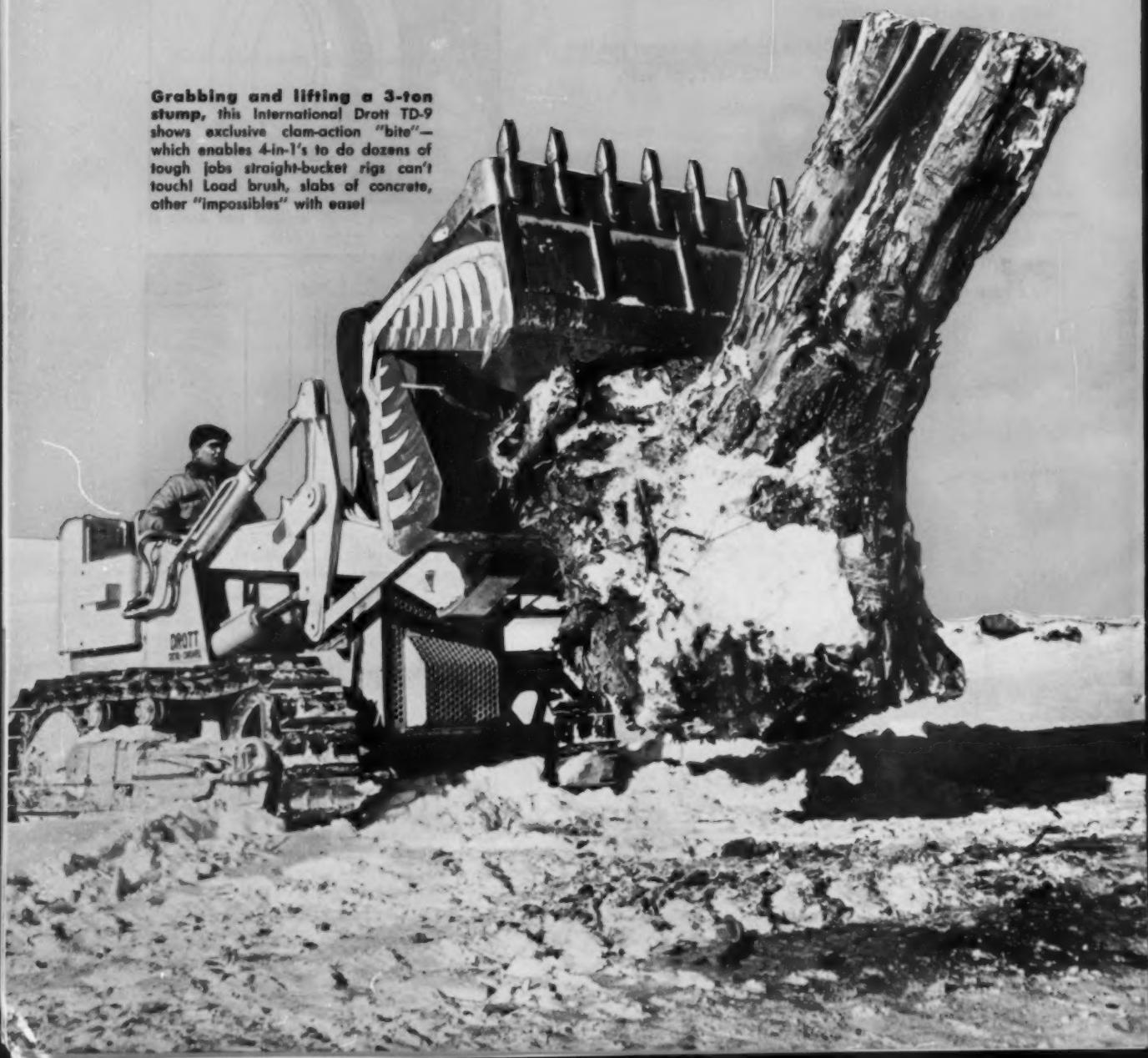


Push entering pipe until the first painted stripe disappears and the second stripe is approximately flush with bell face. The joint is sealed . . . bottle-tight, permanently! The job's done . . . fast, efficiently, economically. Could anything be simpler?

*Choose the "bucket with the bite..."
an exclusive clam-action 4-in-1...and*

Your City Gets A Whole Equipment Spread of Job-speeding Actions!

Grabbing and lifting a 3-ton stump, this International Drott TD-9 shows exclusive clam-action "bite"—which enables 4-in-1's to do dozens of tough jobs straight-bucket rigs can't touch! Load brush, slabs of concrete, other "impossibles" with ease!



"Dragonized" to dramatize "the bucket with the bite," the stump-toting International Drott TD-9 Four-in-One demonstrates one of the many exclusive plus-actions the exclusive clam-action delivers!

Move the hydraulic selector lever and quick as a wink you also get full-capacity, full-range depth-controlled bulldozer action. Two seconds later, you can be grading, stripping, or spreading materials, "carry-type scraper" fashion, with inch-close accuracy. Next instant, the 4-in-1 can be positively bottom-dumping sticky materials that stop other rigs "in their tracks." Then, like a flash it can be back-dragging to grade, pick up, or pull down materials. Or "clamming-on" to heavy, unwieldy "impossibles" like stumps and loading them wholesale!

In addition, the 4-in-1 gives you the top excavator-loader performance on the market—including certified break-out forces ranging from 11,200 lbs with the T-340 to 43,150 lbs with the TD-20! And only the clam-action 4-in-1 has the performance-protection of exclusive shock-swallowing Hydro-Spring.

See for yourself how many "machines" the only modern loader is—how many thousands of dollars of "budget relief" a 4-in-1 can deliver your city. Prove you get a whole spread of work-speeding actions—that obsolete "single-action" loaders, and double for a yard-full of limited-duty rigs! Let your International Drott Distributor demonstrate!

See how "the bucket with the bite" delivers sanitary landfill efficiency no other outfit even approaches. The clam-action 4-in-1 can spread, level, cover, and compact refuse to guarantee minimum-cost sanitary landfill waste disposal. Here, the TD-9 Four-in-One as "carry-type scraper" is evenly covering on-the-go, refuse it had "layered" and "ironed down."



Another "biting action" as "carry-type scraper"—this TD-15 Four-in-One is grading a street with inch-close accuracy. Watch the earth "boil" in! You can strip and spread materials with this same versatile action!



End the sticky materials problem for good with 4-in-1 clam-action—even where other loaders are helpless. Note how opening the clam of this TD-15 Four-in-One pulls material from bucket surfaces—gravity pull does the rest, to enforce clean dumping!

With the clam up and the blade segment in position, "the bucket with the bite" doubles for a full-size, full capacity bulldozer—most anywhere. This TD-9 Four-in-One is grading for sidewalks in a new subdivision.



International Harvester Company, Chicago 1, Illinois
Drott Manufacturing Corp., Milwaukee 15, Wisconsin



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One man, in one day, makes 540 collections!



**"Our Hydro E-Z Packs fit perfectly
into our profit operation."—**



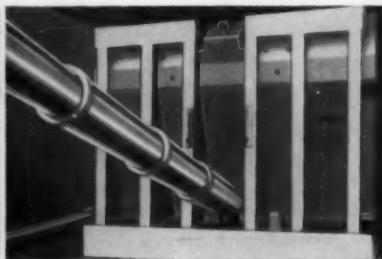
RUSSELL SNOW,
Manager,
Refuse Service, Inc.

In Battle Creek, Mich., one man with a Hydro E-Z Pack makes 540 residential collections a day for Refuse Service, Inc., with only one trip to the landfill. This most powerful of all refuse compactors applies a 76,600 lb. squeeze to reduce garbage and all refuse to a compact bale. At the landfill the compactor blade

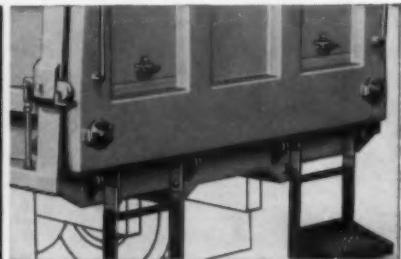
pushes the load out through the endgate in less than 90 seconds. No hoisting or weighting needed! You can see why Russell Snow, Manager, says, "Our E-Z Packs fit perfectly into our profit operation." Now write us. We'll help arrange a demonstration and send you a free copy of an informative book, "The Big Squeeze."



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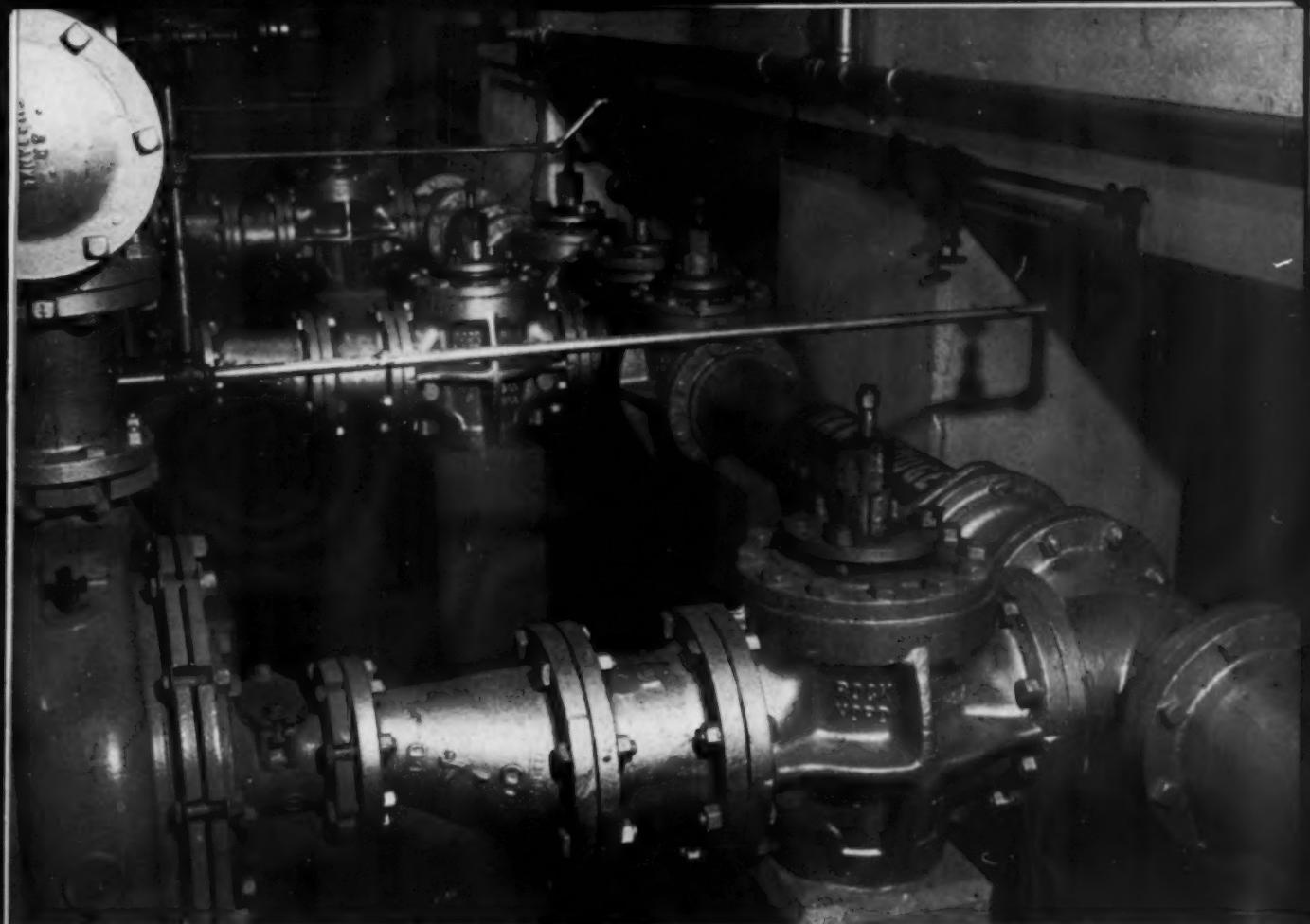


Watertight and sanitary! Six strong latches (with level release) hold one-piece door in contact with seal.



HYDRO E-Z PACK®

HYDRO E-Z PACK DIVISION OF HERCULES GALION PRODUCTS, INC., GALION, OHIO, U.S.A.



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Dozens of Rockwell-Nordstrom lubricated plug valves control the flow of sludge through sedimentation, concentration and incineration at the Allegheny County Sanitary Authority's new Pittsburgh sewage treatment plant. This facility, completed in 1959, is the world's largest plant incinerating concentrated raw sludge, with a flow of 150 million gpd.

The Authority's engineers chose rugged Rockwell-Nordstrom valves for one major reason: their proved performance in sewage services as-

sures long, trouble-free life and lowest valve costs.

Costly down time for stuck valves is eliminated with the Rockwell-Nordstrom design: pressurized lubricant sealing prevents solids from getting between plug and seat. This pressurized lubricant also forms a leakproof seal for positive shut-off on the heaviest sludge or the lightest gas.

Rockwell-Nordstrom lubricated plug valves are available in sizes from $\frac{1}{2}$ inch to 36 inches; pressure ratings to meet your needs. Use the coupon to get complete information.

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- high productive capacity
- simple, easy operation
- fast, easy servicing
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This 1½ cubic yard 955H, owned by Polk County, Georgia, can load a 5 yard truck in less than 60 seconds. It could easily truck-load 2200 tons in an 8-hour shift. District Foreman John Davis says the 100 HP 955 is the best rig that he's ever had anything to do with. "And I've been in the business for years," he says. "The 955 loads easily and has plenty of power. We do a lot of digging with it." Like its brothers, the 977 and 933, the 955 has lifetime-lubricated rollers, a rugged undercarriage and a dependable Cat-built diesel engine.



This 2½ cubic yard 977H, owned by Anderson County, South Carolina, is being used to build \$1,500,000 of new roads, replacing those closed by the Hartwell Dam in the Barkas Creek section. "Power shift really pays off for us," says John Ashley, County Supervisor, "because we generally don't have a crew with a lot of equipment experience. Our new men get good production out of the 977 in only a few days. We've found out that it's an easy machine to keep in good operating condition, too. That helps stretch our budget."

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Refuse	page 52

Improve Your Parking Lot Layouts

43. A new set of 6 parking lot templates is offered free for use in planning practically any type of parking arrangement at industrial plants and public buildings. Write for T-6 to Maintenance Inc., Wooster, Ohio, or check our card-number.

Packer Adds Efficiency to Refuse Transfer Systems

98. Automatic equipment for receiving and compressing industrial wastes to provide maximum payload per trip is described in the "O'Connor Packer" folder of O'Connor Transfer Systems, Inc., 331 Madison Ave., New York 17, N. Y. Check reply card for your copy.

Advantages of a Portable Brush Chipper

100. Bulletin describes the machine and suggests how to use the chips it produces as a soil conditioner and to control rutting, erosion and dust. Ask for Bulletin C-3 from Gruender Crusher & Pulverizer Co., 2915 N. Market St., St. Louis 6, Mo., or use our reply card.

Sewer Pipe Joint Sealing Compounds

104. Hot poured or cold applied, fully described in workmanlike file that gives specifications and prices. For your useful copy address Allied Materials Corporation, P. O. Box 7278 39th Street Station, Oklahoma City, Oklahoma, or use our handy reply card.

Split-Case Centrifugal Pumps

111. . . . for general water supply, with extra large capacity. 4-page folder contains wealth of information and specifications. Output ratings up to 4000 gpm for service against heads up to 400 ft. Write for Bulletin No. 1200 to Weinman Pump Mfg. Co., 290 Spruce St., Columbus 15, Ohio, or use our reply card.

Engineering Data on Truck Mounted Snow Plows

116. Trip cutting edges, one-way plows, push frames and reversible snow plow moldboards are covered in literature from Flink Co., Streator, Ill. Check the reply card.

Economical B.O.D. Removal

117. Handsome booklet goes into the details of this "Total Oxidation Sewage Plant" for service to population groups up to 3,000 where major sewage facilities are unavailable or uneconomical. Ask for Bulletin 6520-A from Infilco Inc., P. O. Box 5033, Tucson, Arizona, or use our card-number.

Snow Plows and Road Scrapers

128. Here is a ten-page illustrated booklet that no highway or street maintenance engineer or official will want to enter next winter without. Your copy, by the above title, awaits you free on request of Root Spring Scraper Co., Kalamazoo, Mich., or use our card.

How to Stake Lime More Successfully

136. . . . is the subject of a new multi-page book complete with drawings and data sheets. Gives thorough description of best methods and equipment for this purpose. For your free copy write for "Facts" of lime-slaking to B-I-F Industries, P. O. Box 276, Providence 1, R. I., or circle number on the card.

SANFAX SG-873



To order these helpful booklets check the reply card opposite page 34.

NEW LISTINGS (Cont.)

Latest Data on Butterfly Valves

119. Bring yourself up to date on the new standards for rubber-seat butterfly valves. 4-page illustrated folder gives latest details with specifications of each size and type. Take a minute to write for Bulletin 6 from The Henry Pratt Co., 319 W. Van Buren St., Chicago 7, Ill., or check our card-number.

Sewer Sealing by Plastic Injection

137. Cure infiltration and exfiltration in your sewers by this method which includes after-inspection by TV camera. 4-page folder lists not only methods employed but 7 services offered for water control problems. Write for Bulletin No. 4 to The Penetron System Inc., 2294 Scranton Road, Cleveland 13, Ohio, or use reply card.

"Low Bid? Best Buy?"

144. Don't miss this penetrating analysis of the "Low Bid" fallacy, put out in tabloid form with some thought-provoking case histories included. Have this presentation of bid facts before your next letting. Ask for Form D111 from Caterpillar Tractor Co., Peoria, Ill., or check number on our card.

Detachable Refuse-Container System

151. New 6-page 2-color brochure tells how one truck becomes a "fleet" for bulk material or refuse handling. Capacities to 40 yards, loads to 30,000 lbs. Ask for Bulletin No. HH 61102 from The Heil Co., Milwaukee 1, Wis., or use our card.

Bare Pavement Maintenance With Sterling Rock Salt

158. Handbook is designed for road maintenance men who are responsible for safe winter pavements; and is a safe-roads fact book about a modern snow and ice removal program. Check the reply card or write International Salt Co., Inc., Clarke Summit, Pa.

Ice Control Without Corrosion Dangers

164. Virtually all corrosion is prevented when rust inhibitor "Banox" is used in conjunction with salt for snow and ice control. Properties of this material and performance results are described in bulletins issued by Calgon, Inc., Hagan Center, Pittsburgh 30, Pa.

Hard to Select

A Standby Electric Plant?

168. With this brochure it becomes easy. A "must" for those who need emergency power, it discusses every usual question that must precede selection, gives suggestions for planning and designing of the standby installation. Write Onan Division, Studebaker-Packard Corp., 2515 University Ave., S.E., Minneapolis 14, Minn.

New Tractor-Mounted Sweeper

171. For use with lightest model utility tractors. Maneuverable and versatile, can be used in actual paving process. For full range of its abilities, write for complete information to The Young Co., 200 Mill St., Waco, Texas.

For Faster, Cleaner Snow Plowing

172. Get literature on this additive for stopping snow and slush build-up on plow blades and protecting all metal parts of plow and truck against corrosion and rust pitting. Address Sanfax Corp., P. O. Box 604, Atlanta, Ga.

New Highway-Surface Photographic Recording

182. Reduces need for lengthy field inspection. Many uses in various types of surveys and encroachment studies. Special literature is yours free on request of Aero Service Corp., 210 E. Courtland St., Philadelphia 20, Pa.

Before the Snow Flies

201. Get latest literature on complete line of reversible and one way plows, spreaders and leaf and litter collecting equipment from Good Roads Machinery Corp., Minerva, Ohio.

STREET LIGHTING AND TRAFFIC CONTROL

Complete Catalog on Traffic Control Equipment

240. All types of controllers, PR system of coordinated traffic control, vehicle detectors, timers, vehicle counters and radar speed meters are covered in catalog available from Automatic Signal Div., Eastern Industries Inc., Norwalk, Conn. Check the reply card.

Manual on All Types of Traffic Signs

379. This 26-page manual covers regulatory, warning, school, railroad, street name, road construction, route markers, miscellaneous signs and plastic reflectors. Check the reply card or write The Miro-Flex Co., Inc., 1824 East Second St., Wichita 14, Kans.

Sign Catalog

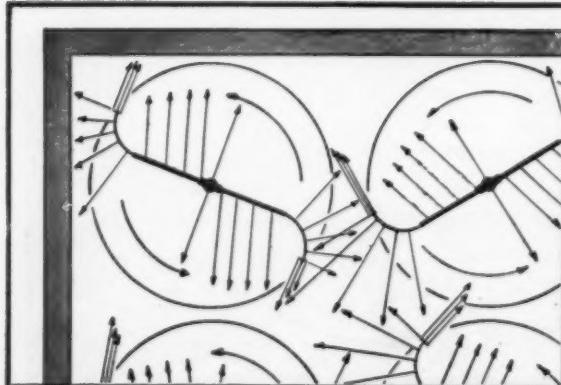
Has Latest Specifications

417. Detailed information on all classifications of standard signs for traffic control, street identification and other purposes together with a complete line of accessories is presented in a convenient Sign Manual by Lyle Signs, Inc., 2731 University Ave., S. E., Minneapolis 14, Minn. Get Catalog B-55 for most recent data and specifications on U. S. Standard signs.

Lighting Standard Equipment

704. Included in these two catalogs, Octagonal Tapered Steel and Aluminum (No. 0-1-860) and Aluminum Round Tapered (R-1-10-60), are new designs in both street and area lighting standard equipment with a good variety of arms to meet most any lighting problem. Traffic Signal Standards and Brackets and Mast Arms for wood, metal pole and wall mounting are included in the Round Aluminum catalog. Write to Kerrigan Iron Works Company, Eleventh & Herman Street, Nashville 2, Tenn., or circle reply card.

NOW! A 25% to 30%
further increase
in filter cleaning efficiency



New S-Type Filter Arms double the cleaning action

With new S-Type arm of Agitator shown above each corner and void area receives four (4) agitating impulses per revolution instead of two . . . doubling the cleaning action in those areas. S-Type Arms can also be adapted to older units in service. Ask us for full particulars.

(Patent Pending)

Palmer Filter Equipment Co.

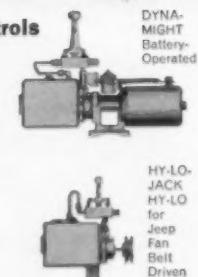
822 E. 8th St.
Erie, Penn.



Monarch Power Hydraulic Controls

Get the jump on winter—get set now for faster snow removal with Monarch Power Hydraulic controls!

With Monarch, lift and lower your snow plow right from the cab . . . automatically. Instant up-and-down action with the flick of the wrist. A Monarch control is quickly installed. See your dealer or write for illustrated folder.



To order these helpful booklets check the reply card opposite page 34.

SNOW AND ICE CONTROL

Uniform Salt Spreading Saves Material

42. The wide, thin pattern provided by Tarco "Scotchman" spreaders avoids salt waste, saves time and labor. Get Folder BL for full details on their spreader and table of material application rates. Use reply card or write Tarco Mfg. Co., Dept. PW, Saratoga Springs, N. Y.

How to Prepare and Maintain Roadways With Calcium Chloride

45. "The Calcium Chloride Road," is the name of a new 24-page two-color catalog issued by the Pittsburgh Plate Glass Co., Chemical Div., 632 Fort Duquesne Blvd., Pittsburgh 22, Pa. Included are sections on dust control, gradation, placing and mixing materials and shaping. General information on spring, summer and fall maintenance is also provided.

Snow on Winter Ice Control Cost

237. With the faster-working salt described in this new Bulletin B-1159S. Tells what this salt will do and why, and where to get it. Also the bonus you get from using salt for summer road stabilization projects. Address Morton Salt Co., Industrial Div., 110 N. Wacker Drive, Chicago 6, Ill., or use our card.

Snow Plows

For Every Need

294. Frink snow plows are designed to meet snow removal needs at airports, parking lots and streets and highways. They consist of four basic types with models to fit trucks 1½ to 12 tons. For complete data write Frink Snow Plows, Inc., Clayton, N.Y.

Hydraulic Controls

Make Snow Plowing Easier

368. Hydraulically operated power controls may be readily installed on trucks that will plow snow this winter. Start preparing now to make winter maintenance an easier job. Get illustrated folder from Monarch Road Machinery Co., 1331 Michigan St., N.E., Grand Rapids 3, Mich. Use the inquiry card.

No Idle Trucks with these Spreaders

397. New 8-page catalog gives features, specifications, users' statements on the Fox Mountable spreaders, equally good for sand, cinders, chips, salt, calcium chloride. Designed for one-man operation and year-round use. Wide widths and high speeds. Mounts or demounts in 15 minutes. Write Fox River Tractor Co., Box 469, Appleton, Wis., or check our card number.

How to Make Icy Surfaces Safe

453. A bulletin on how calcium chloride works in ice control and direction for its use has been made available by Wyandotte Chemicals Corp., Michigan Alkali Division, Wyandotte, Michigan. Other uses of calcium chloride are fully outlined.

Plan for Bare Pavements

All Winter

470. Helpful folders on clear pavement winter maintenance by use of chemical mixtures are offered by Solvay Process Division, Allied Chemical Corp., 61 Broadway, New York 6, N.Y. Circle number on reply card.

Sweepers Handle A Variety of Jobs In Every Season

684. Mechanical drive one-way and pull type 2-way sweepers and hydraulic 2-way sweepers that are tractor-mounted or loader-mounted are fully covered in literature from M-B Corp., 1611 Wisconsin Ave., New Holstein, Wis. Jobs like cleaning dust, dirt and snow from streets and highways and sweeping park lawns are a few of the sweepers applications. Check the reply card.

Salt, Sand and Cinder Spreaders

532. . . . are fully discussed in folder No. A-450 outlining how these are dump body mounted for quick attachment and detachment according to service and season. Basic specifications outlined. Just address Baughman Mfg. Co., Jerseyville, Ill. or use the reply card.

Snow Plows For

Snow Control

539. V-type one-way and reversible plows with hydraulic hoist and having a plowing width of up to 9½ ft. are described in literature from Gledhill Road Machinery Co., Galion, Ohio. For models, specifications and features check the reply card.

WEED AND ODOR CONTROL

Weed and Brush Killer Cartoon Book

253. A novel "Western" approach is used in a cartoon-style booklet to dramatize herbicides for brush control along rights-of-way and mixed brush and weeds. Write for "Diamond Duties." You and your kids will both profit from it. Address Diamond Alkali Co., 300 Union Commerce Bldg., Cleveland 14, Ohio, or use our reply card.

Don't Cover Up Odors, Kill Them

397. New information sheet available that tells what Sani-Septic concentrate can do in roadside, parks and rest areas to render them inoffensive. For your helpful copy just write Werley Chemical & Supply Co., 1505 Broadway, Cleveland 15, Ohio, or check number on card.

(More listings on page 40)

Baughman has the answers to LOW COST ICE CONTROL



Super Spreader . . . This handy spreading attachment fits on rear of regular dump body, handles all types of removal material. New stabilizer arm puts trucks into service faster — no hammer or tools required. Adjustable spreading rate, discharges in both forward and reverse. Fast-acting control clutch allows accurate spot spreading. Available in mechanical chain drive and hydraulically-powered models. Write for Bulletin A-423.

Safety Spreader . . . An exceptionally maneuverable pull-type spreader that can be used on sidewalks, parking lots and other confined areas, as well as for regular spreading on streets and highways. Can be pulled by any vehicle equipped with power takeoff. (Optional auxiliary engine model available at extra cost eliminates need for PTO.) Spreads accurately at all speeds, patterns adjustable up to 32 feet. Write for Bulletin A-453.

Communities that have infrequent or moderate snow and ice removal problems need not spend a lot of money for control equipment — inexpensive Baughman units provide adequate protection on the smallest budgets. Concern for cost control — as well as for ice control — has helped make Baughman the largest manufacturer in this field.



Better service through better engineering . . . service and parts from 200 distributors. A few choice dealerships available.



BAUGHMAN
MANUFACTURING CO., INC.

308 SHIPMAN ROAD, JERSEYVILLE, ILLINOIS

6116

For bare pavement conditions all winter, plan to use Solvay® Calcium Chloride mixed with salt. Consider the advantages of mixtures over salt alone:

- Roads de-iced faster
- Effective melting action well below zero
- Lighter, less frequent application for lower cost

Based on your regional weather conditions, the local Solvay representative will be glad to recommend specific mixture ratios, application rates, and handling methods for greatest effectiveness and economy. Why not contact him today?



SOLVAY PROCESS DIVISION

61 Broadway, New York 6, N.Y.

Plan Now to prevent dangerous icy roads



NEW!

SURE CURE

for a
**FAILING
SEWER**

EVANITE PLASTIC LINERS

Evanite Plastic Pipe Lining is the proved, tested, economical way to make deteriorated sewer lines better than new. Leak-tight liners slide into the failing sewer—keep wastes from seeping out and prevent the infiltration of ground water that overtaxes treatment plants.

You save the cost of excavating and replacing an entire line. And Evanite Liners are so easy to install, an inexperienced crew can do the job perfectly. Light, 10-foot lengths are easy to handle, easy to join. No special skills are required.

The Evanite Plastic Company will assign its own consultants to your job to provide your crews with basic installation instructions, show them how to save time and materials.

Evanite is the newest advancement in the rehabilitation of leaky, corroded, and defective sewers. Write for complete information and technical data.

GUARANTEED 50 YEARS!

Written guarantee
available on request.

Even though the lined sewer may be slightly smaller in diameter, its carrying capacity is generally unimpaired, because of the unique hydraulic efficiency of plastic (with the lowest "n" factor of any pipe material), plus the exclusion of infiltration from ground waters.



Evanite PLASTIC COMPANY

CARROLLTON, OHIO Telephone 68

• LEESBURG, FLORIDA Telephone ST 7-1321

Division of

THE EVANS PIPE COMPANY • UHRICHSVILLE, OHIO

One of the nation's largest manufacturers of face brick, clay pipe, flue lining, wall coping and related construction materials.
More than 50 years of faster, friendlier service.

EVA-361-182A

To order these helpful booklets check the reply card opposite page 34.

WATER WORKS

Acid-Resistant Pipe Linings Can Be Applied in Place

29. The Centriline Process for cement-mortar linings is enlarged to include application of an epoxy-resin 100% solids system to pipe lines in place. Designed for repair and protection of concrete and vitreous sewer lines. Get literature from Centriline Corp., 140 Cedar St., New York 6, New York, or use our reply card.

Handbook of Cast Iron Pipes and Fittings

52. Full engineering data on products of the Alabama Pipe Co., including Super De-Lavaud cast iron pressure pipe and pipe fittings, valve boxes and other municipal castings are provided in Pressure Pipe Catalog No. 34, a 196-page publication of Alabama Pipe Co., Anniston, Ala. Weights, dimensions and specifications are clearly indicated in this easy to use in reference.

Propeller Meters For Dependable Water Metering Control

53. The complete line of Measure-Rite propeller meters are described in Bulletin MK-105 available from Measure-Rite, Inc., 4545 W. Brown Deer Rd., Milwaukee 23, Wis. Check the card for details on these accurate meters.

What You Should Know About Steel Reservoirs and Standpipes

79. The function of ground storage structures in water distribution systems, specifications and maintenance recommendations, are included in an artistic new 20-page booklet. Get yours from Chicago Bridge & Iron Co., 332 So. Michigan Ave., Chicago 4, Ill., or circle our card-number.

Easily Cleaned Long Run Filter Bed Media

70. Bulletins on Anthrafilt tell the reasons why selected, graded crushed anthracite is superior to sand as a filtering material. Have you made a full investigation? Write Anthracite Equipment Corp., Wilkes-Barre, Pa.

Convenient Reference Manual Covers Cast Iron Pipe, Valves and Hydrants

76. An 80-page manual, issued by R. D. Wood Co. Independence Sq., Philadelphia 5, Pa., presents specifications for "Sand-Spun" cast iron pipe and fittings, outlined types of joints available, lists dimensions and weights in convenient tables and includes, in addition, full engineering data on the Mathews and R. D. Wood fire hydrant and R. D. Wood gate valves.

Rapid Sand and Pressure Filter Data

109. Rapid sand filters. A complete line of vertical and horizontal pressure filters, wooden gravity filters, and filter tables and other equipment. For engineering data, write Roberts Filter Manufacturing Co., 640 Columbia Ave., Darby, Pa., or check the reply card.

AWWA Fire Hydrants and Gate Valves

155. Above-ground maintenance Mueller AWWA improved fire hydrants and minimum maintenance Mueller AWWA non-rising stem gate valves are described in literature from Mueller Co., Decatur, Ill.

Valve and Hydrant Construction Details

161. A 72-page catalog-type bulletin, just completed, gives detailed data on construction and application of gate valves, check valves and hydrants for water works service. Write for Bulletin 5710 from Darling Valve and Mfg. Co., Williamsport, Pa., or check the reply card.

Controlling Water in Masonry

101. . . . confronts and puzzles practically every building owner, designer or builder. There is still no "wonder drug" cure-all, but a very valuable 44-page booklet is available that goes farther in diagnosis and suggested remedies than anything we have yet seen. Your copy of "Walls Breathe" can be had from Western Waterproofing Co., 1223 Syndicate Trust Bldg., St. Louis 1, Mo.

Information on Service, Valve, Roadway and Meter Boxes

122. Literature on specifications covering "Buffalo" service, valve, roadway and meter boxes, and adjustable valve boxes for water and gas has just been released from Buffalo Pipe & Foundry Corp., Box 55-Station B, Buffalo 7, N.Y. Check the reply card for your information on these valve boxes.

Valves for Concrete Pipe

208. And no adapters needed. That is the title and the message of this new illustrated brochure in color covering this specific problem in using this type of pipe. Double disc valves with O-Ring Joints are fully discussed. Get Circular No. 26 from M & H Valve & Fittings Co., Anniston, Ala., or use our reply card.

U. S. Tyton Joint Pipe

210. An eight page booklet on centrifugally cast, Tyton Joint® pipe for water or other liquids is available. Tyton Joint cast iron pipe is provided with a simple, sturdy and tight slip-on type of joint. Illustrations show details of joint and method of assembly. Write U. S. Pipe & Foundry Co., Birmingham 2, Ala., or check the reply card.

Pipe Cutter for Cutting Large Size Pipe

254. An all-purpose pipe cutter that can cut pipe in or out of the ditch is described in a bulletin available from Ellis & Ford Mfg. Co., P. O. Box 308, Birmingham, Mich. Check the reply card for sizes and parts list.



for Fast, Efficient Spreading of Bulk Chemicals for snow and ice control.

This is your most Economical unit. You save: by lower initial cost; by using less material; by lower maintenance costs.

"Scotchman" Spreader, Model SS7V3, gives you one-man, cab control. Blows salt on in wide, "birdshot" melting pattern . . . you use less salt. The dump body mounted "Watchman Hopper" . . . either 3 cu. yd. or 5 cu. yd. . . . gravity-feeds salt to spreader, without running with elevated body.

Complete, readily removable, combination costs less than other body type spreading units.

TARRANT MFG. CO.
28 Jumel Place, Saratoga Springs, N.Y.



Three industrious little elements doing the work of 6 is the answer.
Ask for Speed Sensitive Switch Bulletin 604.

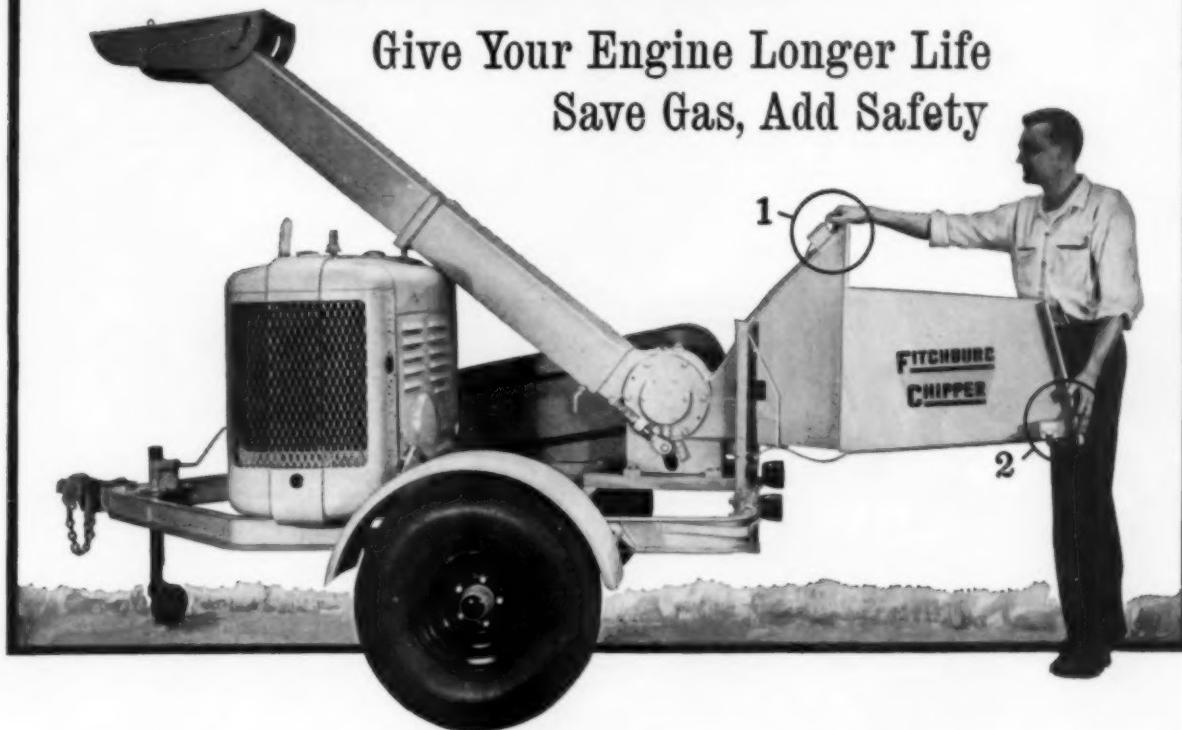
SYNCHRO-START PRODUCTS

Since 1932

8151 NORTH RIDGEWAY AVENUE • SKOKIE, ILLINOIS

2 NEW FITCHBURG CHIPPER FEATURES

Give Your Engine Longer Life
Save Gas, Add Safety



1 EXTRA PROTECTION for your crews with this NEW SAFETY STOP SWITCH that stops all moving parts of the chipper within seconds. Switch is within easy reach at rear so operator can flip it without moving from feed position. An important new feature of the Fitchburg Chipper, *already considered safest* because it has no hard-to-control flywheel.

2 GREATER ECONOMY with this NEW SOLENOID SWITCH* which allows the operator to quickly idle the motor between actual brush feedings. With the motor idling, you save on gasoline and engine wear; and there's less noise, which pleases the public. Your operator can use the switch easily because it is at the rear and handy.

CHIPPING IS SMOOTHER and faster with a Fitchburg because of its exclusive *spring activated*

feed plate. This patented feed plate "gives" automatically under pressure. You can chip even large limbs (up to rated capacity) without killing the engine. And your crews are safer because the feeding action is more positive, smoother, with less whipping of the brush.

CHIPPING IS MORE EFFICIENT with a Fitchburg. The exclusive feed plate allows wood to be chewed up in small bites. This takes less power, and the engine can be run at lower r.p.m.—which is more efficient, saves you gas and cuts engine wear.

TROUBLE-FREE Fitchburg Chippers stay out of your shop so you don't lose valuable man-hours. These rugged machines are the choice of tree surgeons, line clearance contractors and others—men who depend on Chippers day after day to make money. Blades are made from special alloy steel to hold a keen edge for a long time, even with hard use. Fitchburg Chippers are well-engineered, come in four sizes to meet your needs: the largest handle limbs as thick as seven inches with ease.

A FREE BOOK "Chip Dollars" should be in your hands if you deal with brush disposal. 20-pages. Write for free copy — Dept. PW-18.

*optional equipment

FITCHBURG ENGINEERING CORPORATION FITCHBURG, MASS.

To order these helpful booklets check the reply card opposite page 34.

A Comprehensive Handbook on Water Meter Settings

174. "The Engineering of Water Meter Settings" contains 34 pages of clearly illustrated data and specifications to help improve your practices and simplify your work. Every Water Department should have a copy of this valuable reference book. To get yours address Ford Meter Box Co., Inc., Wabash, Indiana, or use the inquiry card.

Manual on

Filter Bed Agitators

206. General information-specifications and installation data regarding the application of Palmer agitators, or rotary surface wash in vertical and horizontal pressure filters—round, square and rectangular open gravity type filters are covered in Manual from Palmer Filter Equipment Co., 822 East 8th St., P. O. Box 1696, Erie, Penna. Check the reply card.

Trenches for Water and Sewer Line Construction

384. Three Cleveland J trenchers incorporating major advances in trencher design and operating advantages are described in Bulletin I-104 available from The Cleveland Trencher Co., 20100 St. Clair Ave., Cleveland 17, Ohio. Check the reply card for digging capacities, specifications and dimensions.

Air Control Valves For All Types of Pipelines

620. Literature on Crispin Air Valves, which safely control air in lines handling liquids, to maintain efficient operation and prevent expensive failures, is available from Multiplex Manufacturing Company, Dept. C, Berwick, Pa. Write today for your copy of the Crispin Air Valve Catalog, which offers complete information on the full line of dependable Crispin Air Valves.

Information on Boring Machines

365. General operating instructions for the Earthworm boring machine, a portable compact unit for underground installation of pipe and conduit are available in new bulletin just released by Earthworm Boring Machine, Inc., P. O. Box 1100, Santa Monica, Calif. Suggested procedures for installing pipe or conduit and a price list are included.

Book Tells

How to Control Algae

371. Details on the control of various microscopic organisms frequently found in water supplies are furnished in a 44-page booklet by Phelps Dodge Refining Co., 300 Park Ave., New York 22, N. Y. Check the reply card.

Manual Answers Your

Water Meter Questions

440. This valuable reference covers the complete line of Trident water meters, giving full descriptions of each type and providing also helpful background information on metering and its advantages. Get your copy of the 28-page Trident Water Meter Catalog. Form 421-1, by checking the reply card or write to Neptune Meter Co., 19 West 50th St., New York 20, N. Y.

Helpful Information on

Elevated Steel Tanks

445. Factors to be considered in the selection of elevated steel tanks plus capacities, dimensions and particulars of many attractive designs are provided in 20-page Bulletin 101 of Pittsburgh-Des Moines Steel Co., Neville Island, Pittsburgh 25, Pa. Use inquiry card to get your copy.

Vertical Turbine Pumps

508. . . . with a history of low maintenance costs and practically no service calls. These data are offered you in the helpful literature to be had from The Deming Co., 293 Broadway, Salem, Ohio. Check number on inquiry card.

Water Meters with

Choice of 7 Features

521. . . . and geared to mineral and chemical characteristics of your water. Complete design flexibility built-in to meet varied needs the country over. Get all the facts with Bulletin 58 of Buffalo Meter Co., Dept. PW, 2917 Main St., Buffalo 14, N. Y., or check the card-number.

Floatless Liquid Level Controls

543. Catalog describes the B/W system of liquid level control, liquid level relays, electrodes, signals and alarms with descriptions, charts and diagrams of typical applications. Check the reply card or write B/W Controller Corp., Birmingham, Mich.

For Pipe Pushing and Pulling, Cut Costs and Time

641. New folder describes continuous-motion machine that eliminates all resetting of grip. Hand or air powered for pipe $\frac{3}{4}$ to 2 inches. Write for new folder to The Trojan Mfg. Co., 1112 Race Drive, Troy, Ohio or use our reply card.

Electronic Locators for Water Mains, Services, Valves and Boxes

677. Miniaturized line locator that is encased in a molded glass fiber container and has transistors that have a rated life of 70,000 hours and weighs only four lbs when completely assembled is described in literature from Wilkinson Products Co., 3067 Chevy Chase Drive, Pasadena 3, Calif. Check the reply card.

Measure Water Accurately In Open Ditches and Channels

694. Parshall Measuring Flumes are widely used by Irrigation Companies, Farmers, Cities and Industries. All steel construction assures accuracy within 2%. Available in sizes for 0.1 to 1340.0 cubic feet per second. Catalog B-31-C contains free-flow discharge tables, sizes, capacities and weights. Thompson Pipe & Steel Co., 3025 Larimer Street, Denver 1, Colorado will send you a free copy for the asking.

STANDARD STEEL TAR-KETTLES

PATCH AND MOVE ON IN MINUTES AND SECONDS

With this Standard Steel Model "S" Kettle, "cold spots" or "burnt materials" are eliminated. You get uniformity of heat throughout the entire mass of material. Steady temperature at the correct level is maintained all day long. Easily transported—equipped with special safety features—it's a fast worker. With a motor spray attachment, it is even more efficient for road maintenance. Standard Steel also offers a complete line of crack filling pots, shoulder rollers and other road maintenance equipment.

WRITE FOR CATALOG AND PRICES



OTHER PRODUCTS OF STANDARD STEEL

Asphalt Pressure Distributors,
Maintenance Distributors, Patch
Rollers, Supply Tanks, Tool
Heaters, Asphalt Tools, Street
Flushers, Construction Brooms.

Standard Steel Works, Inc. NORTH KANSAS CITY, MO.

The complete
sealant line featuring

ALLIED

SUPER SEWER SEAL

(product 5312)

Engineered to give you a permanent sewer joint...with positive protection against joint problems!

- Resists corrosion
- Will not deteriorate at high temperatures
- Positive adhesion
- Stops roots—will not penetrate
- Normal pipe settlement will not rupture sealed joints
- Will not slump in hot weather or crack in cold weather
- Easy to apply, flows freely at positive temperatures

**Allied's Quality Control Saves You Money,
Time and Manpower.**

Every pound of Allied Super Sewer Seal gives you maximum performance for trouble-free sealing. This hot poured sewer joint compound has been engineered to the most rigid specifications by Allied all the way from research and development to production. It has been performance-proved on the toughest jobs. You can use Allied Super Sewer Seal with confidence that it will perform *as specified* under the most rugged conditions.

**The World's Finest Hot Poured and Cold Applied
Sewer Joint Sealing Compounds.**

The Allied line of sewer sealants covers the ENTIRE field. Choose the one suited to YOUR needs . . .

PRODUCT NO.	DESCRIPTION
*5312 Super Sewer Seal	Hot Poured Plastic Type
*5310 Sewer Seal	Hot Poured Asphalt Type
*5311 Sewer Seal	Hot Poured Asphalt Type
*9859 Sewer Seal	Hot Poured Coal Tar Type
*9865 Sewer Seal	Hot Poured Coal Tar Type
7206 Sewer Seal	Cold Applied Asphalt Mastic Type
6963 Sewer Seal	Cold Applied Asphalt Mastic Type

**These Products meet all requirements under Federal
Specifications SS-S-169*

For further information about ALLIED SUPER SEWER SEAL and the complete ALLIED Sewer Seal line, write:



MATERIALS CORPORATION

Producers, Refiners and Compounders of Special Asphalt and Coal Tar Products

Allied Building • 5101 N. Pennsylvania • P. O. Box 7278-39th Street Station • Oklahoma City, Okla.
PLANTS: Stroud, Okla. • Detroit, Mich. • Los Angeles, Calif.

To order these helpful booklets check the reply card opposite page 34.

CONSTRUCTION EQUIPMENT AND MATERIALS

New Literature on Tractor Loaders

55. Full illustrated descriptions on Allis-Chalmers TL-12 and TL-14 Tractor Loaders are furnished in bulletins MS-1386 and MS-1373 respectively. Write Allis-Chalmers Construction Machinery Div., Milwaukee 1, Wis.

Added Loader Attachments Add More Mileage for Your Tax Dollar

383. are the intriguing title and content of this handy 16-page pocket-size booklet listing new equipment and new uses for the PAYLOADER you have or the one you are going to get. Ask for "More Mileage" from the Frank G. Hough Co., Libertyville, Ill.

Selection of a Small Packaged Air Compressor

387. Catalog 1548 contains tabular and chart information on cu. ft. of air required to operate a variety of pneumatic equipment, average and continuous air supply tables and charts on ratios of compression and tables on flow of air through orifices. Check the reply card or write Ingersoll-Rand Co., News Service Dept., Phillipsburg, N. J.

Industrial Tractors and Equipment

625. In this very complete new catalog you will find not only a full line of equipment descriptions but the full gamut of industrial applications such as digging, earth moving, mowing and snow removal, to name a few. Your copy is available from International Harvester Co., 180 N. Michigan Ave., Chicago 1, Ill., or by checking our card number.

Tractors and Equipment for Municipal Use

487. Specification sheets for the John Deere crawler and utility wheel tractors; also equipment for loading, dozing, mowing, sweeping and many other operations. John Deere, Industrial Division, Moline, Ill. Check the reply card. State type of tractor and equipment.

Manual

on Construction Castings

462. This 168-page Manual covers catch basin inlets and traps, building castings, manhole covers and steps, flap valves, wheel guards, drainage grates and many other construction and maintenance castings. Check the reply card or write Neenah Foundry Co., Neenah, Wis., for your copy.

Pneumotracitors, Their Tools and Accessories

489. These machines, applicable to a multitude of jobs, are comprehensively described in a folder that every public works official and engineer will find revealing and useful. Ask for Catalog 5945 from Schramm, Inc., West Chester, Pa., or ring the number on our card.

Big Tractor-Powered Equipment

540. Including tractor shovels, dozers, scrapers, loggers and special equipment models and features illustrated and described in attractive brochure available from Clark Equipment Co., Construction Machinery Div., Benton Harbor, Mich. Or just check number on our card for us to order for you.

Prestressed Concrete

in Your Construction Needs

647. Prestressed beams, slabs and girders for bridges are covered in information available from American Steel & Wire, Rockefeller Bldg., Cleveland 13, Ohio. Check the reply card for complete details.

Transit Cranes for Bridge and Highway Building

691. Transit cranes that can lift 33,000 lbs. at 20-ft. radius, and 13,000 lbs. at 40-ft. radius with 60-ft. boom and outriggers set are described in literature from Bucyrus-Erie Co., South Milwaukee, Wisconsin. Also featured are load control, folding boom and boom lengths.

The Complete Public Works Construction and Maintenance Machine

703. Is the apt title of a comprehensive folder on The Gradall which can be an eye-opener in describing its versatility in all public works construction and maintenance operations. Get the full picture by writing for "Population Explosion" folder to Warner & Swasey, 5701 Carnegie Ave., Cleveland 3, Ohio, or check number on the card.

100 HP Motor Grader

715. Model 330-H features a constant-mesh transmission, 8 forward and 4 reverse speeds, full-diesel rubber-mounted engine. With hydraulic brakes, ample strength and weight, and a wide range of blade adjustments. Write for bulletin (Form No. M6-174) from LeTourneau-Westinghouse Company, Peoria, Illinois, or circle reply card.

BUSINESS ADMINISTRATION

Save Space

By Filming Your Records

37. Microfilm your records by using the Recordak Microfilmer. Check the reply card or write Recordak Corp., 415 Madison Ave., New York 17, N. Y., for operation, use and price of this machine. Also available is literature on the Recordak Verifax Copier that makes certified copies 15 times faster than typing.

Stop Waste in Hand Washing

497. Quick cleanup after the job with a saving of soap and your employees' time is easy with Gojer hand cleaner and dispensers. You'll find it pays you, too. Get details from Gojer, Inc., Box 991, Akron 9, Ohio.

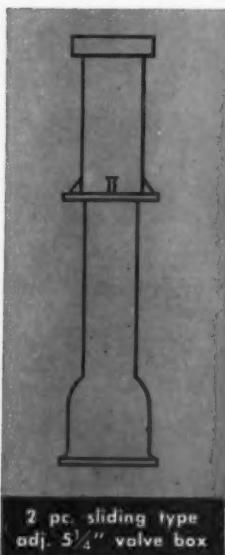
PUBLIC WORKS for August, 1961



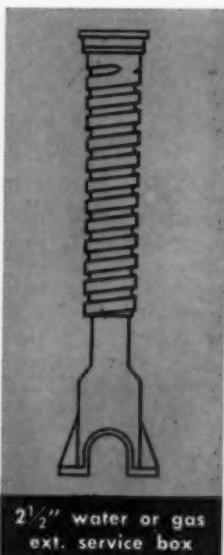
BUFFALO MUNICIPAL CASTINGS

are available in every size and style!

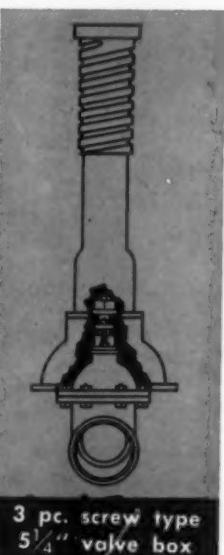
No matter what size, shape or style municipal casting you may desire — you're practically sure to find a "Buffalo" casting to serve your needs. Or, where desired, castings may be made to your own specifications. Whether you need valve, service or roadway boxes, meter boxes, manhole rings and covers or other municipal castings, you'll find all "Buffalo" castings designed for service and dependability.



2 pc. sliding type
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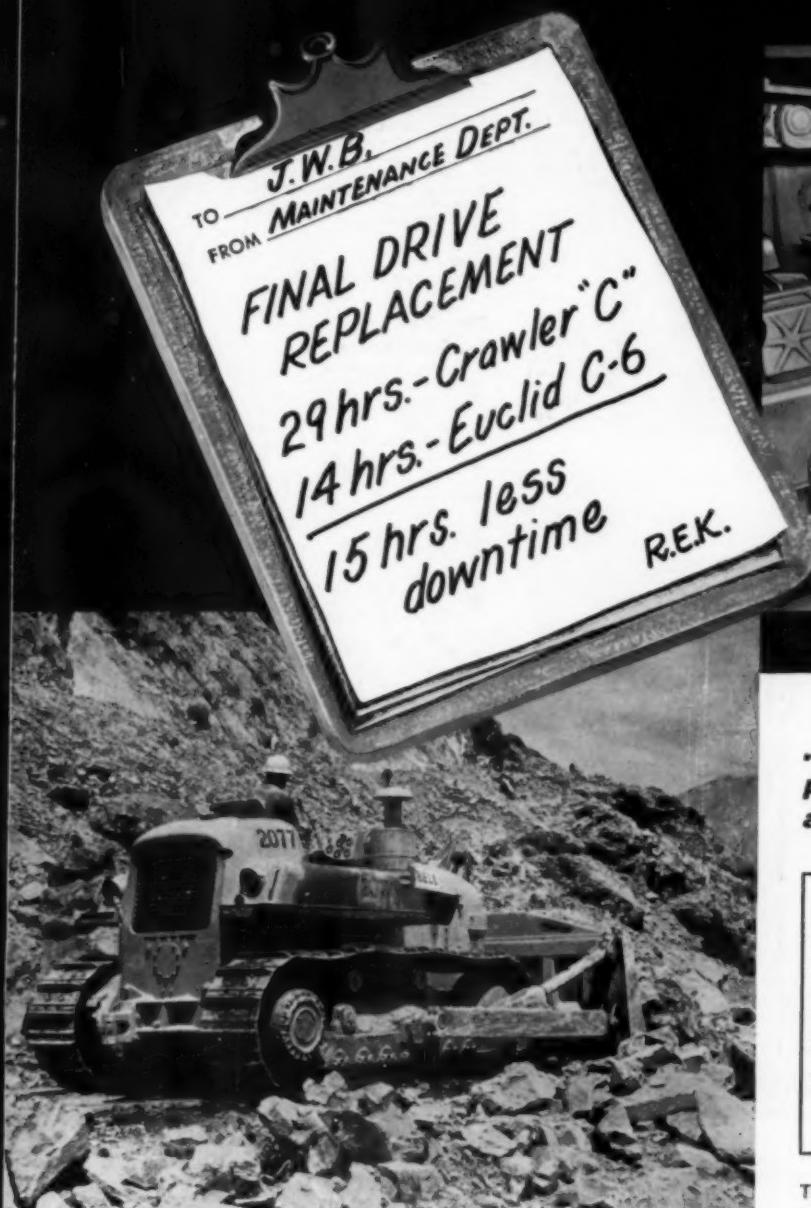
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Prompt quotations given on all
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Write or wire Dept. J for Bulletin M11

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**BUFFALO PIPE &
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BOX 55 — STATION B-DE 6764 BUFFALO 7, N.Y.



...a saving of 15 hours labor and productive time with the C-6 and no special tools required!

C-6	Crawler "C"
Planetary Gears	Gears and Bearings 16 hours
Inside pinion and drive gear reduction	Top pinion from steering clutch with bearing and shaft 13 hours
Total 14 hours	Total 29 hours

Times shown are for removal and replacement of final drive with all components in place.

With a 15 hour saving for final drive replacement the "Euc" C-6 gives you 15 hours more productive time on the job! Easy accessibility that's designed into the C-6 and Euclid's time-tested planetary drive save hours of repair labor . . . that means less downtime and more production. Compare these savings in terms of lower costs . . . add the

extra hours available for work on the job . . . then you'll see what just this one advantage can do in cutting operating cost.

▲ The Euclid dealer in your area would like to prove that the C-6 is the lowest cost tractor in the 200 h.p. class . . . and the most versatile by far. He's sure of it, and wants you to know the facts, too!



EUCLID

DIVISION OF GENERAL MOTORS, HUDSON, OHIO

Plants at Cleveland and Hudson, Ohio and Lanarkshire, Scotland

To order these helpful booklets check the reply card opposite page 34.

SEWERAGE AND WASTE TREATMENT

What You Should Know About Trickling Filter Underdrains

20. Specifications for vitrified clay under drain blocks conforming to ASTM standards, suggestions for layouts and construction of trickling filter floors, dimensions of standard blocks, channel covers, angles and other fittings are available from the Trickling Filter Floor Institute c/o Editor, Public Works, 208 So. Broad St., Ridgewood, N. J. Check the reply card.

Stationary Engines For Sewage and Water Treatment Plants

22. Engines that operate on sewage gas, gasoline, butane or natural gas are described in literature from Climax Engine Mfg. Co., Div. of Waukesha Motor Co., Clinton, Iowa. Check the reply card.

Automatic Engine Control Equipment Manual

83. This catalog contains descriptions of standard automatic and semi-automatic controls and control equipment. General control recommendations, control selection chart, accessory selection chart, safety stop controls and alarm sets are sections covered. For price lists and models available write Synchro-Start Products, Inc., 8151 N. Ridgeway, Skokie, Ill.

Stationary Diesels For Water and Sewage Plants

167. Engines are four-cycle, 6 or 8 cylinder, in-line models, ranging from 190 to 2150 bhp and from 135 to 1500 KW, are available either naturally aspirated or supercharged, and can be furnished to run as diesel, dual-fuel or gas engines. For Bulletin #215A check the reply card or write White Diesel Engine Div., The White Motor Co., Springfield, Ohio.

Package Plant Provides Big-City Sewage Treatment

41. With a design based on the "Ten State Standards," the Bio-Pac employs two-stage bio-filters, primary and secondary settling and sludge digestion, all in a single corrosion protected steel shell. Design criteria for selecting appropriate sizes for residential, industrial plant, restaurant, motel and trailer court and school use are featured in Folder 2971. Also given are dimensions and installation data for 50 to 300 population equivalent plants. Write to Link-Belt Co., Colmar, Penn.

Transite Pipe For Sewer Mains

166. Johns-Manville "Transite" Sewer Pipe, made of asbestos-cement, is available in 11 different diameters ranging from 6" to 36" and in five new crushing strengths to permit greater efficiency in system design. "Ring-Tite" Coupling, designed for high-speed assembly, provides tight, long-lasting seal. Easy-to-assemble Transite sewer fittings also furnished. For complete information, write for brochure TR-165A (Transite Sewer Pipe), TR-94A (Sewer Design Flow Chart), and DS-366 (Transite Material Specification). Johns-Manville, 22 East 40th St., New York 16, N.Y. Check reply card.

Package Sewage Plants for 50—5000 Population

181. Design information on Walker "Spar-jair" package sewage treatment plants for sizes from 50 to 5000 population equivalent is presented in a 12-page bulletin, No. 19-S-94. Typical plans and sections, special design considerations, specifications and a discussion of the "how" and "why" of the contact stabilization process are included. Check the inquiry card or write Walker Process Equipment, Inc., 840 No. Russell, Aurora, Ill.

How to Save \$264 per Mile

216. . . . in sewer cleaning is the gist of a new 8-page brochure that discusses just how such savings can be accomplished. It costs nothing to find out and it may be your best investment of the day. Write for it to Flexible, Inc., 415 South Zangs Blvd., Dallas 8, Texas, or circle the card number herewith.

Gratings for Sewage, Water and Lighting Plants

217. Aluminum or welded steel gratings and treads, according to your needs, are well described and illustrated in literature to help you design, specify and select. Write for file No. AIA 14-R to Grating Division, Rockwell-Standard Corporation, 4000 East 7th Avenue, Gary, Indiana, or check the inquiry card today.

Technical Data on Plastic Sewer Main Pipe

228. An attractive and most useful booklet that gives the information you will need in considering this modern material for sewers. Goes into engineering details on stresses, crushing resistance and abilities to withstand acids, cleaning and all other common hazards to which working sewers are exposed. Ask for the book from Evanite Plastic Co., Uhrichsville, Ohio.

Controls for Water and Sewage Pumps

428. Condensed data sheet gives you valuable information on applications and operation of Rot-O-Trol controls. Before you design automation in pump service, write Healy-Ruff Co., 2255 University Ave., St. Paul 14, Minn., or check card number.

Data on Adjustable-Speed Magnetic Drives for Low-Lift Pumps

465. A catalog is available from Electric Machinery Mfg. Co., Minneapolis 13, Minn., that tells all about E-M Vertical Synchronous Motors and Magnetic Drive Units. Engineers check the reply card for information on this equipment for sewage pumps.

Bitumastic For Lasting Protection Against Corrosion

570. Bitumastic protective coatings prevent corrosion of metal and deterioration of concrete and masonry and are fully covered in catalog from Koppers Co., Inc., Tar Products Div., Pittsburgh 19, Pa.

DAILY PERFORMANCE TESTS PROVE the Superior Advantages of . . .



Prostran-Polypropylene Gives You These Advantages—

- Excellent Sweeping Efficiency
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"There goes the old playground!"
loaded out at low cost by a John Deere 1010

To prepare ground for a new automobile driveway and turn-around space at an elementary school, the excavating contractor used its "1010" Crawler-Loader to tear out a portion of the old playground surface and sections of the existing blacktop driveway.

The loader operator commented, "I like the "1010"—especially the single-lever loader control—no fumbling around with levers. For fast loading, you can't beat the new hydraulic direction reverser, either. The machine has plenty of power for getting a full load."

Compact and fast-handling, the

John Deere "1010" rates high with operators and owners, private contractors and city operating departments. New 4-cylinder, 4-cycle gasoline and Diesel 40 h.p. engines deliver the versatile performance loader operation requires—on earthmoving and material-handling jobs as well as specialized applications, such as sanitary landfill.

Complete specifications are available through the John Deere dealer. For details, contact him now through your classified telephone directory. John Deere 3300 River Drive, Moline, Illinois.



**TRACTORS
LOADERS
LANDSCAPING
AND
MATERIAL
HANDLING
EQUIPMENT**

To order these helpful booklets check the reply card opposite page 34.

Tips for Installing Orangeburg Pipe

336. Good practice for installation of Orangeburg pipe and fittings is outlined in an illustrated four-page bulletin made available by the Orangeburg Mfg. Co., Div. of The Flintkote Co., 375 Park Avenue, New York 22, N. Y. Trenching and backfilling, pipe laying, cutting and connecting.

Engineering Data on Gas Safety Equipment

343. P.F.T. Gas Safety Equipment for Controlled Digestion is the subject of an excellent 12-page bulletin issued by Pacific Flush Tank Co., Chicago 13, Ill. Full engineering data on flame traps, pressure releases, waste gas burners and related equipment is provided in convenient form. Requests for this valuable booklet must be made on business letterhead.

Getting Improved Sludge Dewatering With Non-Clogging Vacuum Filters

425. Latest information on the Komline-Sanderson "Coilfilter," which features non-clogging, permanent filter media to obtain constant output and low operating cost is presented in illustrated Bulletin No. 106 by the Komline-Sanderson Engineering Corp., Peapack, N. J. Be sure to investigate this improved method of sludge dewatering. Check the reply card today.

Reinforced Plastic Pipe and Fittings

549. . . . for water and sewage service, in sizes 2 through 8 inches, made of epoxy resins and glass, highly resistant to hydrogen sulfide gas, electrolysis and difficult soil conditions. Booklet tells all in 16 illustrated pages. For your copy write Amercoat Corporation, 4809 Firestone Blvd., South Gate, Calif., or circle number on the card.

Judging Engine Quality

565. . . . may be hard but this 26-page booklet emphasizes the features of various designs which provide you with top engine performance for minimum cost—original and/or final. Cutaway illustrations compare these features for quick grasp of their importance. Write for Form 20185-DN935 to Caterpillar Engine Div., Peoria, Ill., or just check off our card-number.

Equipment For Sewage Disposal Plants

585. Sewage gas meters, gas regulators, lubricated plug valves and water meters are described in Bulletin C-5200-3, available from Rockwell Mfg. Co., Meter and Valve Div., 400 N. Lexington Ave., Pittsburgh 8, Pa.

Manual on Solving Drainage Problems

645. An 80-page Manual on the problems of drainage and drainage materials is available. Design section includes determining culvert lengths and sizes, run-off calculations, excavation of base and backfilling data. Check the reply card or write Bethlehem Steel Co., Bethlehem, Pa., for the third revision of this valuable book containing new tables for evaluating flow friction.

Sludge Removers for Tanks of Any Size or Type

659. The Rex Unitube Tow-Bro Sludge Remover is described as a proven standard of the industry. Bulletin 315-81 shows how Tow Bro can be applied to tanks of any size or type. Write Chain Belt Co., Milwaukee 1, Wis.

Reinforced Concrete Pipe For Culverts and Sewers

672. Elliptical Lo-Hed and Hi-Hed pipes, round pipe and flat base pipe are described fully in literature from American-Marietta Co., Concrete Products Div., 101 East Ontario St., Chicago 11, Ill. Headwall details, discharge curves, hydraulic capacity tables and hydraulic properties are included. Check the reply card.

Factory-built Sewage Treatment Plants to Serve Smaller Users

673. Complete factory-built Oxigest sewage treatment plants for small subdivisions, schools, motels and factories are described in detail in an illustrated brochure furnished by Smith & Loveless, Div. of Union Tank Car Co., Lenexa, Kansas.

STREETS AND HIGHWAYS

To Measure Moisture Content and Density

28. Engineers will find in this 12-page booklet invaluable information on necessities, methods and instruments involved. To get your free copy just ask for "Moisture-Density Determinations" brochure direct from Testlab Corp., 3398 Milwaukee Ave., Chicago 41, Ill., or by using our time-saving reply card.

Road Rollers, Scrapers, Distributors or Street Flushers . . .

287. Whatever your need from fill to finish, there's a Seaman product to help you build better roads at lower cost. Before you do anything in this line or on soil stabilization write for specification sheets to Seaman Division, Seaman Corp., P. O. Box 3025, Milwaukee 18, Wisc., or check our card-number.

Bituminous Distributors for Public Works Uses

376. New "Road Builders" bulletin includes description of distributors 1000 to 1500-gallon capacities, including the Model 658 with "compact car" design, plus tank kettles, spreaders, and construction brooms. A lot of good information. Bulletin SE-60-25M, Standard Steel Works, Inc., North Kansas City 16, Mo.

(More listings on page 52)



***mysophobia** (my" so-pho' bi-a) n. Pathol. 1. dread of dirt. Common among public works officials charged with good housekeeping in municipal parking lots, garages, on sidewalks around civic centers and parks, in sports areas, equipment yards, warehouses—wherever large Wayne street sweepers can't operate. Attempts to use old-fashioned pushbroom methods and costly manpower only aggravate condition. Cure invariably effected with Wayne Power Sweeper of proper size. Ease of operation, large hopper capacity, job to job portability, and savings in manpower and time, plus improved civic cleanliness with a Wayne have great calming effect. Prescription without charge obtained by writing direct to Wayne. Distribution, parts and service everywhere.



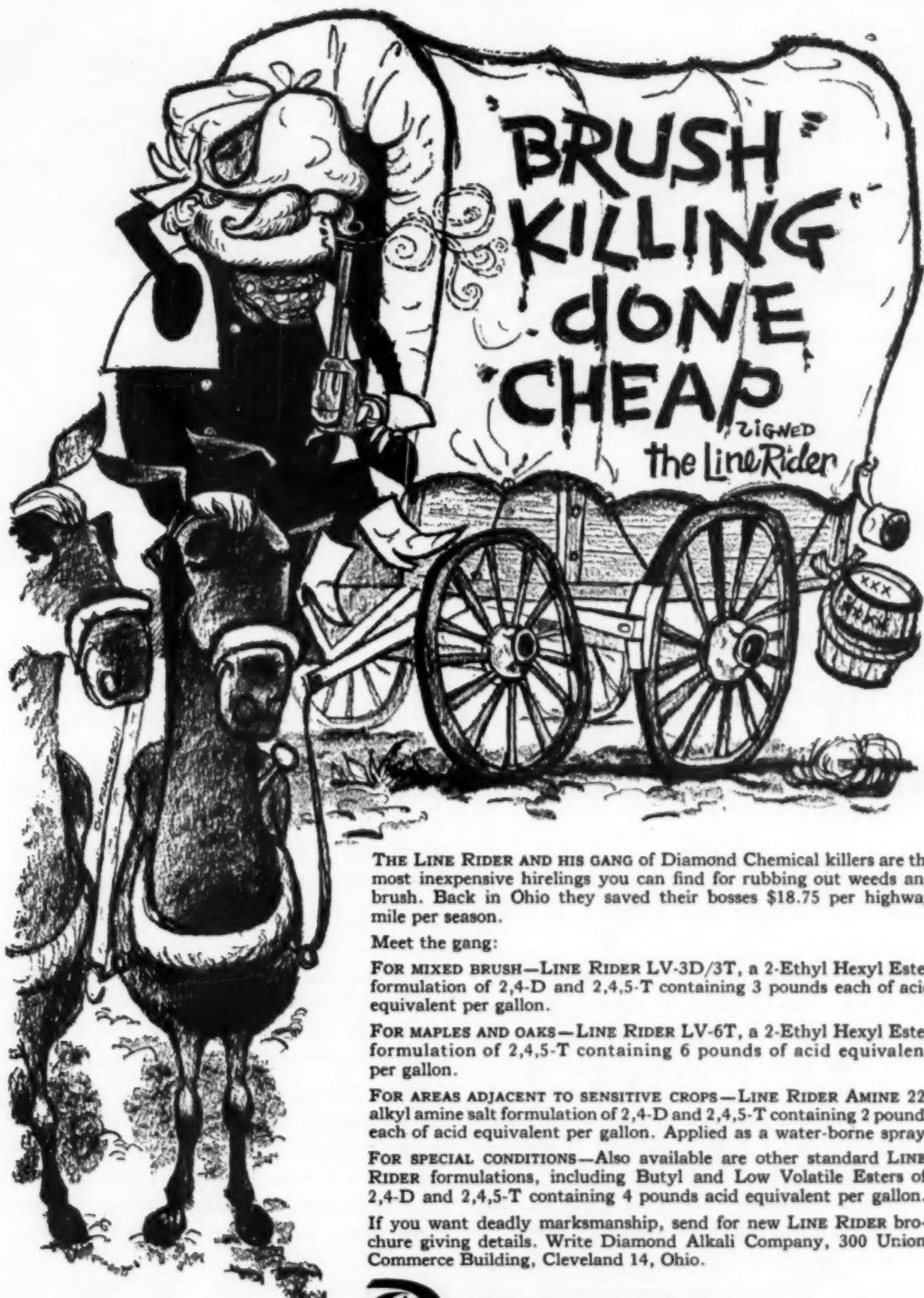
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THE LINE RIDER AND HIS GANG of Diamond Chemical killers are the most inexpensive hirelings you can find for rubbing out weeds and brush. Back in Ohio they saved their bosses \$18.75 per highway mile per season.

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FOR MIXED BRUSH—LINE RIDER LV-3D/3T, a 2-Ethyl Hexyl Ester formulation of 2,4-D and 2,4,5-T containing 3 pounds each of acid equivalent per gallon.

FOR MAPLES AND OAKS—LINE RIDER LV-6T, a 2-Ethyl Hexyl Ester formulation of 2,4,5-T containing 6 pounds of acid equivalent per gallon.

FOR AREAS ADJACENT TO SENSITIVE CROPS—LINE RIDER AMINE 22, alkyl amine salt formulation of 2,4-D and 2,4,5-T containing 2 pounds each of acid equivalent per gallon. Applied as a water-borne spray.

FOR SPECIAL CONDITIONS—Also available are other standard LINE RIDER formulations, including Butyl and Low Volatile Esters of 2,4-D and 2,4,5-T containing 4 pounds acid equivalent per gallon.

If you want deadly marksmanship, send for new LINE RIDER brochure giving details. Write Diamond Alkali Company, 300 Union Commerce Building, Cleveland 14, Ohio.



Diamond Chemicals



The 2 yd. 105 HP (flywheel) 944 Traxcavator—Proven by seven years of testing and widely accepted after a year in the field, this machine offers the Cat power shift transmission for instant shifting, forward and reverse, 1st and 2nd speeds. Other wheel loaders include the 2½ yd. 966 and 1¼ yd. 922. Also available is a line of track-type loaders; the 2½ yd. 977, the 1¾ yd. 955, and the 1½ yd. 933.

CATERPILLAR REPORTS HOW TO GET MAXIMUM MACHINE VALUE THROUGH BEST BID BUYING

Many communities have laws requiring lowest bid buying. Unfortunately, this intended protection of public funds collapses when applied to construction equipment.

Supervisor Bernard Amell, of the Plattsburgh, N. Y., Town Board, explains the realities of equipment buying this way: "The accepted machine cost figure must include not only the initial price tag but also the more important items such as fuel and oil consumption, ease in servicing, maintenance costs, final trade-in value, and source of replacement parts and service to eliminate down time. Failure to include these charges is hiding the true costs of the machine from the public."

When all these factors are included, this is Best Bid buying. It's Best Bid because it's real; it's Best Bid because the lowest *total* cost is best for taxpayers.

HERE ARE REPORTS FROM COMMUNITIES WHO BOUGHT ON BEST BID BASIS:

Vermont Division of Highways When this state organization began keeping records on two motor graders purchased in 1950, they found that the machine that cost more initially proved to be the best buy in the long run because it cost nearly \$8000 less to operate over a nine-year period.

Harrison County, Indiana Accurate, by-machine cost records showed that a year-old Cat No. 12 Motor Grader required only a set of head gaskets and two spark plugs, with \$25 labor, in one year. Two new machines of another make required major engine repairs, new clutches and side shift linkage during the same period.

Plainview, Texas This city kept operating costs on a Cat No. 212 Motor Grader and found that it



The 100 HP No. 112F—This new turbocharged motor grader will earn its keep in constant availability and low operating costs. It features the proven oil clutch which gives up to 2000 hours of operation without adjustment. The No. 112F is one of the four models available from 85 to 150 HP.



The 93 HP D8B Tractor—Featuring a Cat D333 Engine with unusually high lugging ability, this versatile tractor typifies the quality of Caterpillar-built equipment. The proven oil clutch, dry-type air cleaner, and lifetime lubricated track rollers help keep this one on the job with a minimum of servicing. Caterpillar's range of five tractor sizes extends from 52 HP through 335 HP.

cost only \$100 for repairs over five years. On a Best Bid basis, they recently bought a Cat 955 Traxcavator.

Escambia County, Florida Machines purchased on a Low Bid could not be put back in operation quickly because it took a week or longer to get parts. Now, buying on a Best Bid basis, city officials feel the savings in upkeep will more than offset the initial price differences.

Dallas County, Texas Purchasing agents awarded the purchase contract to the highest bidder. They bought the higher price machines when the records proved that the low-price machines would cost over \$12,000 more to operate over a ten-year period.

Plattsburgh, New York In addition to the long life of Caterpillar equipment, this city considers immediate availability of parts and services as part of the low cost of buying on Best Bid basis.

INITIAL COST • OPERATING COST DOWN TIME • RESALE VALUE

When all these factors are taken into consideration,

public and government officials all over the country have discovered that this Best Bid approach to purchasing points to Caterpillar. Some of the reasons are dependability, lower repair costs and fewer of them, top performance and high resale value of the Cat-built machines.

Individual machine cost records prove that Caterpillar equipment working on governmental jobs means more savings to taxpayers. See your Caterpillar Dealer for such records on jobs in your area. He'll also be glad to give you Time and Cost Record Books which allow you to keep individual records on your own machines.

Caterpillar Tractor Co., General Offices, Peoria, Ill., U. S. A.

CATERPILLAR

Caterpillar, Cat and Trademark are Registered Trademarks of Caterpillar Tractor Co.

QUALITY-BUILT MACHINES
—LOWEST TOTAL COST

To order these helpful booklets check the reply card opposite page 34.

Power Sweepers for Cramped Quarters

91. How to gain the advantages and economies of power sweeping in numerous common smaller areas is the subject of these color-illustrated descriptive sheets. Ask for Bulletins 703-4-S and 6 direct of Wayne Mfg. Co., 1201 E. Lexington St., Pomona, Calif., or just check our card-number.

To Sweep a Better Street for Less

162. Find out about what Prostran can do to make your street sweeper brooms last longer, cut "down-time" and lower your cost per sweeping mile. A folder, with sample polypropylene filament is yours for the asking from E. B. & A. C. Whiting Co., Burlington, Vermont.

Don't Haul and Burn Brush, Dispose of It on the Spot

196. How you can do this the easiest way with Fitchburg Chippers is the theme of 16-page illustrated catalog that can save you work and grief. Gives experiences of others and describes simple mounting on truck body or on trailer, tractor or jeep. Write Fitchburg Engineering Corp., Fitchburg, Mass., or just use reply card.

Your Motor Grader Operators Can Greatly Benefit

268. By the reading of new 20-page fully illustrated booklet with a world of information specifically on how to operate a motor driven grader most efficiently. Attractive and easy to read. For yours, write Galion Iron Works & Mfg. Co., Galion, Ohio, or use the reply card.

What Henry Didn't Know

About Tractors and What It Cost Him

313. This is the theme of a "comic book" that has as much sound information and sense in it as it has laughs. And there are plenty of both. Moral: Ignorance is not bliss. When it is costing the tractor owner money. Your men will appreciate it. For copies, write for "Henry's Crawler," to Advertising Dept., J. I. Case Co., Racine, Wis., or circle our reply card.

Complete Line of Asphalt Patching Mixers

586. Mixers capable of mixing 3 to 20 tons of hot mix per hour are described in literature available from McConaughy Mixers, Inc., Lafayette, Ind. Check the reply card for full information on patching, repairing, resurfacing and sealing.

Design of Concrete

Pavements For City Streets

657. Sections covered in this manual are classes of streets as to traffic, quality of concrete, working stress and safety factor, types of pavement design, design procedure, jointing of municipal pavements and use of distributed steel. Check the reply card or write Portland Cement Association, 33 West Grand Ave., Chicago 10, Ill.

Versatile Crawler With Power and Controllability

707. Within this 24 page booklet (Form No. 607R) are liberally illustrated descriptions of the features of the Euclid C-6 for clearing, dozing, stripping, grading and a variety of other applications. Specifications covered. Circle reply card or write to Euclid Division of General Motors Corporation, Cleveland 17, Ohio.

REFUSE COLLECTION AND DISPOSAL

Load-Packer 600 Points the Way to the Best in Refuse Collection

188. Bulletins W-200, W-220 and W-221 explain how the Gar Wood Load-Packer gives faster operation, bigger payload, more compaction, a larger hopper and more dependable operation. Write Gar Wood Industries, Inc., Wayne, Mich., or check the reply card.

Select Your Incinerator Scientifically

275. Here is a new swift simple way of selecting the correct industrial, institutional or business-use incinerators for various types of installations. The device is somewhat like a slide rule and takes in the variable factors which determine choices in incinerators. Get yours from Morse Boulger Inc., 80 Fifth Ave., New York 11, N. Y., or check number on our card.

How to Construct

A Sanitary Fill

331. A new 12-page booklet which tells the most efficient method of sanitary fill construction and furnishes complete information on planning and operation is now available from Drott Mfg. Corp., Milwaukee 15, Wis. Get your copy by checking the reply card; you'll find this booklet both interesting and valuable.

Prompt Service on Sweeper Refill Fibers

367. Here's a dependable source of power sweeper refill fibers, including domestic and imported types and gutter broom wire. To get all the data write A. Steiert & Son, Inc., Hatfield, Pa., or use our reply card.

New Dempster Book

507. . . . tells the full, illustrated story of what Dempster Brothers offer in the way of wastes collection, containerization and disposal equipment. 28 pages in color. Get your copy from Dempster Bros., Knoxville, Tenn., or circle our reply card.

Data on the Hydro E-Z Pack Refuse Collection

572. This disposal unit has no moving chains, no whirling knives, and has a 76,600 lb. pressure that takes anything and compacts everything. Check the reply card or write Hydro E-Z Pack, Div. of Hercules Galion Products, Inc., Galion, Ohio, for a copy of Bulletin EZ-100.

WATER MEASUREMENT

... accurate
easy to read

PARSHALL MEASURING FLUMES

Easy to read, accurate water flow indicator. Not affected by silt deposits or stream velocity. Easy to install. Heavy gauge steel; will not warp, swell or crack.

WATER WELL SCREEN FOR EVERY SOIL CONDITION. Choice of perforations and 4 field joints. Stainless, and galvanized steel. From 6" to 36" diameters.



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AUTOMATIC WATER CONTROL GATES
Accurately control water level upstream or downstream, in canals, ditches and reservoirs, regardless of flow. Eliminates washouts, flood damage and labor costs, (no gate keeper necessary).



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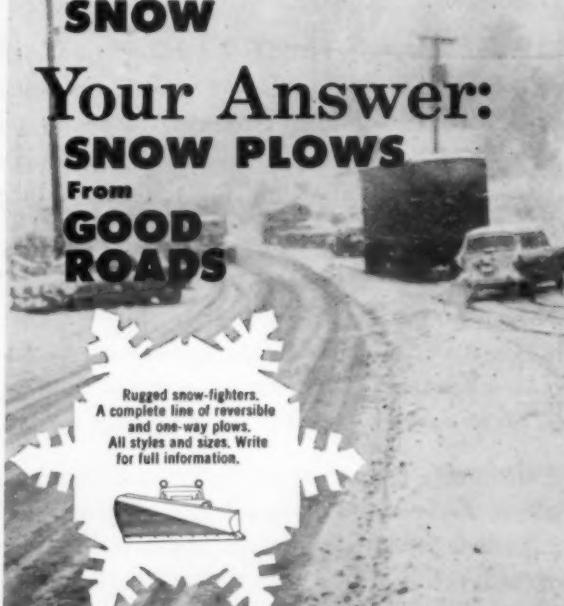
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Problem: You must install a high-cost yet brittle porcelain insulator in a hard-to-get-at spot. No chipping allowed. No touching of that maze of wires and structures. And as always, time is important.

Solution: Use a HYDROCRANE® all-hydraulic crane. It's the only complete answer. You thread your way through traffic. You cruise at highway speeds. You set up instantly, solidly and safely on four hydraulic outriggers. You pick up the insulator and "nose" it into

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Handling kid-glove stuff like this is what puts the HYDROCRANE in a class by itself. Let your Bucyrus-Erie distributor show you the outstanding job it does on hundreds of jobs. Bucyrus-Erie Company, South Milwaukee, Wisconsin.

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MIAMI BEACH KEEPS CLEAN WITH GAR WOOD LOAD-PACKERS



Gar Wood Pax-All Containers Cut Costs On Commercial Routes

In addition to the fast packing speed of the Load-Packer 600 there is another feature that is speeding collection time for municipalities and private collectors on commercial routes: Gar Wood's Pax-All Container System.

The completely hydraulic operation of this system is controlled with one lever. Pax-All containers snap quickly on and off without use of chains or cables. And the Pax-All system is actually *300% faster* than the cable method on other packing machines.

Increased speed in refuse collection



means fewer man-hours, less maintenance, reduced costs. The Pax-All Container System is just one example of engineering developments that make the Gar Wood Load-Packer 600 the fastest and most economical packer in use today.

With several million visitors arriving each season, and with a reputation for beauty to be maintained, Miami Beach is especially demanding in its refuse collection requirements. Hotels, restaurants, and business establishments are serviced daily, apartment buildings every two days. The job must be done as fast and efficiently as possible.

To find the *best* machine for this job, the city tried and tested several competitive packers. The result: Miami Beach chose the Gar Wood Load-Packer exclusively, and now operates a fleet of 33 units.

Maximum payloads and low maintenance were the reasons behind the choice, city officials state. The Load-Packer has the biggest hopper of any 16-yard packing machine, carries the biggest payloads because dead weight has been cut to a minimum. And, since the Load-Packer packs faster than any competitive machine, each crew can work a longer route.

Today, municipalities and private collectors throughout the country are getting far more efficient refuse collection, and are making tremendous savings in time, money and manpower with Gar Wood Load-Packers—the most advanced refuse collecting machines ever manufactured.

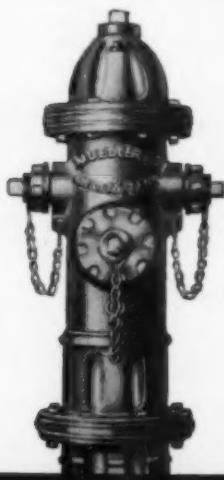
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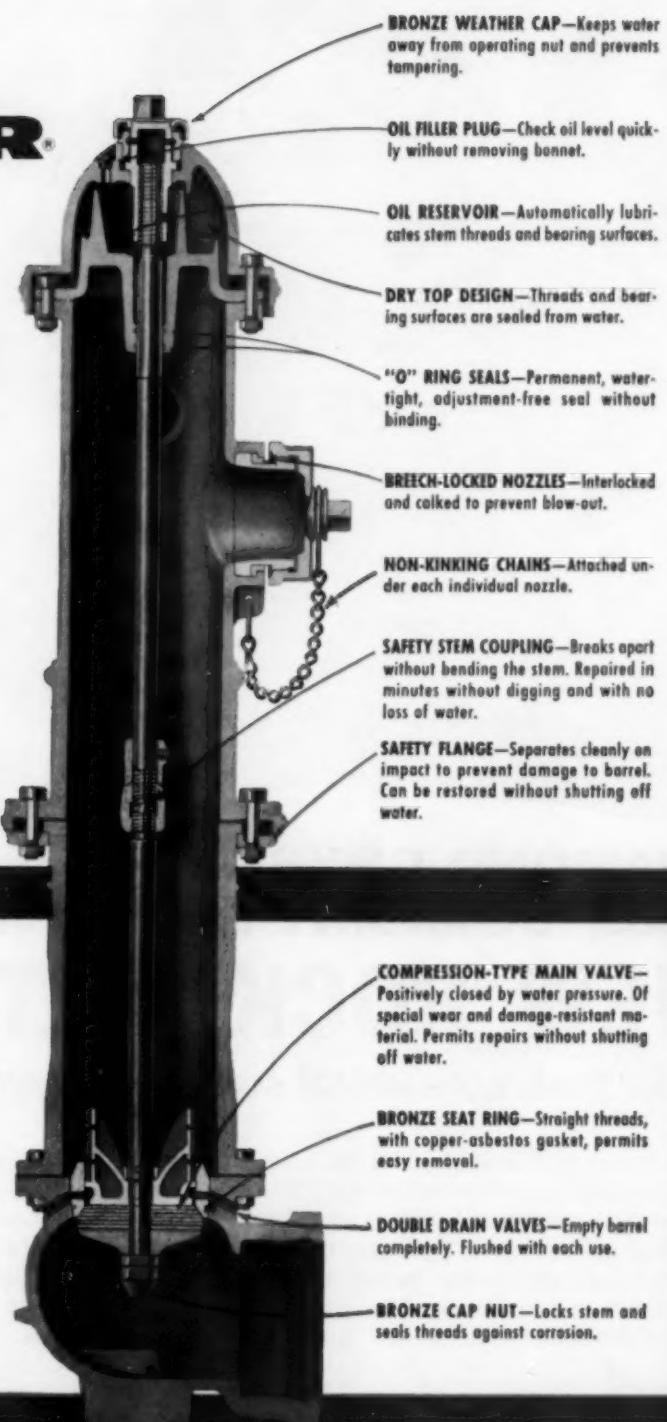
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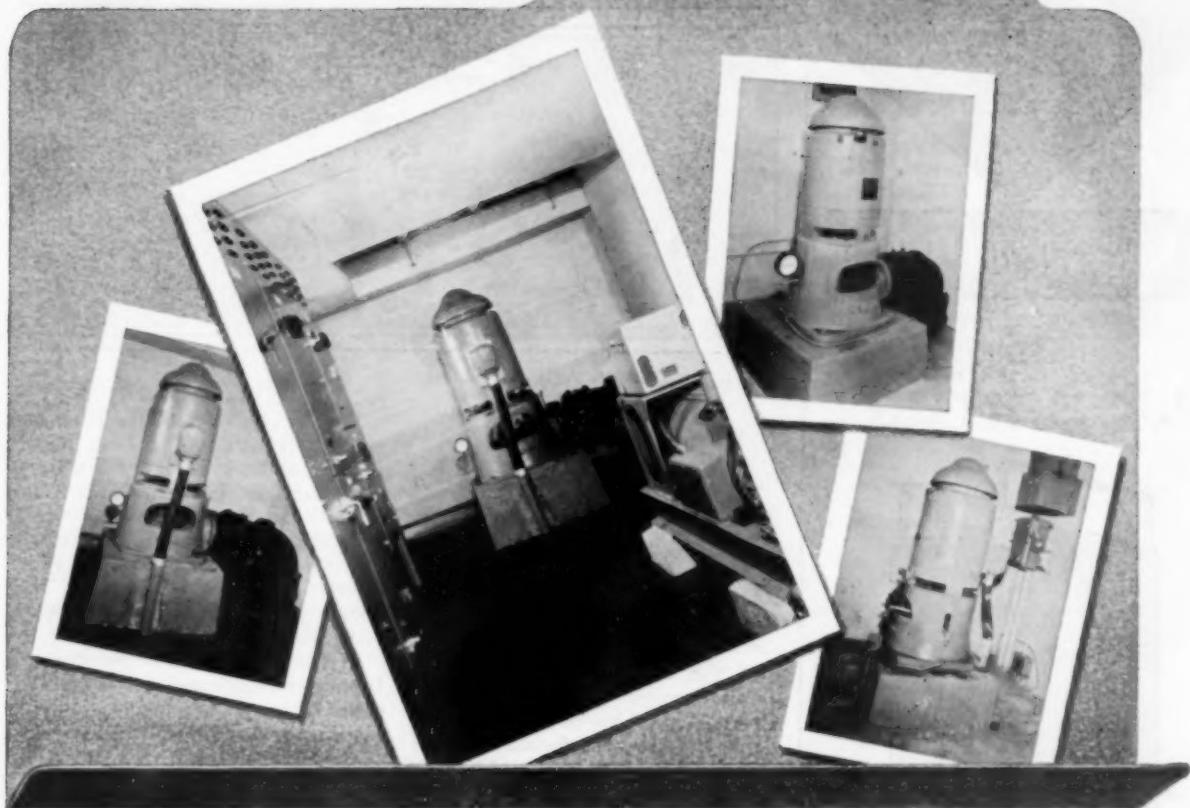
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Total years on the job 28
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Consider this when you begin planning expansion or replacement of your pumping facilities:—Four DEMING Turbine Pumps at the modern public water works of Mahwah, New Jersey, have been on the job steadily since 1953—without a single service need.

Rated pump capacities: 1400 G.P.M., 600 G.P.M., and two at 800 G.P.M. Drive: electric motor; with diesel auxiliary for the 125 h.p., 1400 G.P.M. pump. Discharge pressure: 80 pounds. Pumping level in wells: 100 feet from surface.

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Widely known for their simplicity of design, and engineered to handle both emergency and normal demands smoothly, DEMING Turbine Pumps have established an enviable record of low maintenance cost.

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MAINTENANCE RECORD—DEMING PUMPS

Year	Pump #1	Pump #2	Pump #3	Pump #4
1953	none	none	none	none
1954	none	none	none	none
1955	none	none	none	none
1956	none	none	none	none
1957	none	none	none	none
1958	none	none	none	none
1959	none	none	none	none
1960	none	none	none	none

Please send me full information on the complete line of DEMING pumps for municipal service.

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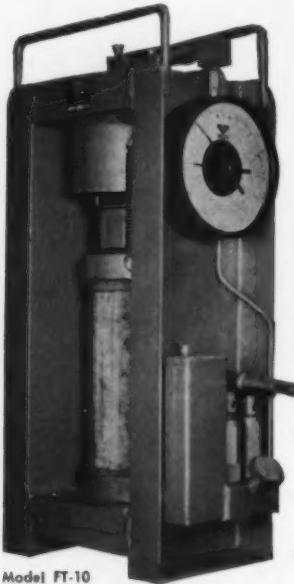
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"JOBSITER" is only one of a complete line of concrete testing machines. When better low priced testers are built—Forney's will build them.

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LEGAL ASPECTS

OF

PUBLIC WORKS

MELVIN NORD, Dr. Eng. Sci., LL.B.

Defect in a Crosswalk

Becker v. City of LaCrosse, 109 N.W. 2d 102, a Wisconsin case decided May 2, 1961, was an action by a pedestrian against the city for injuries sustained in a fall caused by a defect in a crosswalk.

The city produced testimony to the effect that it had repaired a hole in the pavement about one foot south of the crosswalk two days before the accident and the defect in the crosswalk developed after the repair because of the crumbling away and the deterioration of the asphalt coating over the old brick pavement. A witness for the plaintiff testified she fell at the same place in the crosswalk in the fall of 1957 or the spring of 1958 and the hole or defect existed then. There was no evidence of any actual notice by any city official responsible for street repair.

The court held that it was proper for the jury to find that the city had no notice of the defect in the sidewalk, i.e. that it had developed within the two days after the city had done work within a foot of the crosswalk. Consequently, the judgment of no liability was affirmed.

**Condemnation of Right of Way
to a Lake**

Branch v. Oconto County, 109 N.W. 2d 105, a Wisconsin case decided May 2, 1961, was a proceeding by the county to condemn a right of way to a navigable lake, for use by the public to reach the lake for duck hunting.

Christy lake consists of 390 acres. It is shallow, with a mucky bottom. The average depth is about two feet. It is partially surrounded by bog. It has an outlet stream. It affords no fishing or swimming opportunities, but is excellent for duck hunting.

John Branch acquired the property surrounding the lake, and does

not permit access to it except for a fee. On two sides of the lake, his property consists of a strip about 100 feet wide. The county can purchase land from another owner for a road to the edge of Branch's property. The county board voted to condemn a piece 50 feet wide across Branch's 100-foot strip. The purpose of this is to provide access to the lake for duck hunters.

In the condemnation proceeding, Branch was allowed \$1500 by the court, although the jury had found a reduction in value of the property of \$3500. Branch appealed, contending that the chief value of his property was his virtual monopoly of the use of the public lake, because of his right to exclude the public from ready access to it.

The Supreme Court of Wisconsin held that the benefit he was able to derive from exclusion of the public from the lake (which under Wisconsin law is held in trust by the state for the use of all its citizens) was not a right for which he is entitled to compensation.

**Collapse of Sewer
Connection Trench**

Weber v. City of Hurley, 109 N.W. 2d 65, a Wisconsin case decided May 2, 1961, was an action against the city for injuries sustained by the plaintiff caused by the collapse of a sewer connection trench dug by an independent contractor who was hired by the plaintiff and who was told by city officials where to dig.

In the course of building a home on leased land in the city of Hurley, plaintiff applied to the city for permission to make connection to the sewerage main. With the City's knowledge, plaintiff hired Matt Johnson, who made the basement excavation for the home, to dig a trench from the sewer main to the home. The city reserved the right to break the paved surface of

How sewage pumping is made easier with an Ampli-Speed magnetic drive

by Warren J. Birgel
Electrical Engineer
Electric Machinery Mfg. Company

For years a common method of varying the speed of sewage pumps to match flow rate was by use of wound-rotor induction motors. In recent times, however, a new electrical device has won wide acceptance for its efficient speed control capabilities. This device is the eddy-current slip coupling, or magnetic drive.

With a magnetic drive installed between a constant-speed motor and the pump, pumping speed is adjusted with a simple potentiometer control.

The constant speed electric motor-magnetic drive combination provides an all-electric system that offers distinct advantages in planning new pumping installations or in redesigning older ones. Here's how:

Smaller Wet Well. With a magnetic drive on one or more pumps, the wet well or grit chamber can be made 25-35% smaller because it must handle only average flow, rather than maximum flow. With constant-speed drivers, the wet well must be designed for maximum flow.

Improved Plant Performance. With adjustable speed pumping, sewage feed through the plant is more even . . . the surging associated with

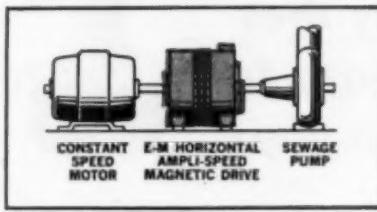


W. J. Birgel

constant-speed pumping is eliminated. In some cases, this makes it possible to avoid kilowatt demand penalties.

Less Pump Wear. With constant-speed pumps, the sudden-start surging of sand and gravel into the pump can often damage the impeller and casing rings. With a suitable automatic control system and magnetic drive, grit does not settle out because pumping is continuous. Abrasives move into the pump in suspension, with far less chance of pump damage.

Permits Plant Expansion. Expansion flexibility is inherent in magnetic drive pumping. The automatic control system can be easily enlarged to include other pumps in sequence.



HORIZONTAL INSTALLATION is compact. And air-cooled Ampli-Speed requires no complex cooling system, may be installed and treated like a motor. E-M builds Ampli-Speed Drives to fit all pumping applications.

Ampli-Speed Gives You Precise Adjustable-Speed Pumping

E-M specialists, through extensive research into sewage pumping requirements, have developed a highly efficient, precisely engineered magnetic drive called Ampli-Speed. Check these Ampli-Speed features:

Simple Control. For manual control, operator adjusts potentiometer knob. Quickly adapts to automatic liquid level control systems.

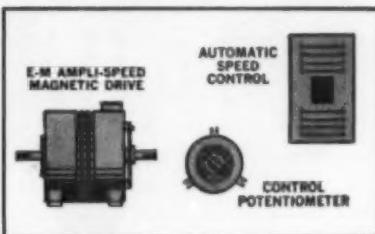
Precise, Stepless Speed. Output speed held to close tolerances. Provides smooth, stepless speed changes.

Compact Installation. Ampli-Speed requires no more floor space than that required by drive motor on vertical installation, very little more on horizontal installation.

*Specialists in
making drives do
exactly what you
want them to*

Air-Cooled. Can be installed and serviced like an air-cooled motor.

Easy Maintenance. No heavy brush currents . . . no electrolytes.



SIMPLICITY OF AMPLI-SPEED installations allows sewage plant operators to derive maximum benefit from adjustable-speed pumping systems. Simple control components keep maintenance to a minimum.

Ampli-Speed is available for either vertical or horizontal installations, with wide range of input speeds. And E-M has designed applications through 800 hp.

Call your nearest E-M Sales Engineer now for qualified assistance in planning a really efficient sewage pumping system for your plant. Or write to Electric Machinery Mfg. Company, Minneapolis 13, Minn.

Write for Free Booklet!

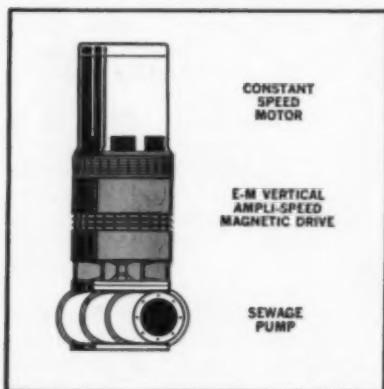


Contains a wealth of information helpful in planning sewage pumping systems. For your copy, write Electric Machinery Mfg. Company, Minneapolis 13, Minnesota.



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VERTICAL INSTALLATION requires no more floor space than constant-speed motor. Magnetic drive becomes integral with motor. E-M builds vertical Ampli-Speed Drives in a wide range of ratings.



Now a low cost sign and bracket assembly that meets LYLE standards for quality and durability!

Caught in a squeeze between quality and price in your street signing program? Here's your answer! LYLE has developed a special one-piece alloy aluminum bracket assembly, to give you a lower purchase price and lower installation cost. The bracket is matched to LYLE's standard style name plates (it contains magnesium for greater tensile strength without brittleness) and is an important addition to LYLE's wide variety of highly readable sign styles and exceptionally durable materials.

**LYLE SIGNS
STILL SPARKLE LIKE NEW
AFTER YEARS OF SERVICE!**

LYLE craftsmanship and quality control puts extra long life into every sign. Many "old-timers" are still in service because they look like new and there's just no need to replace them! (Incidentally, LYLE keeps all patterns and dies in stock so it's easy to expand your sign program without loss of uniformity 15 to 20 years hence.)

Send for the new, fully illustrated
LYLE Street Name Sign Catalog.

Lyle **SIGNS, INC.**
2722 University Avenue S. E.
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the street and to determine the location, depth and direction of the digging.

Johnson first dug a square hole, about five feet by five feet, approximately six and one-half feet deep, at the place in the street where the city employees had determined the location of the sewer main to be. Then he proceeded to dig a trench from the hole toward the plaintiff's house. He was instructed by the city as to the depth and direction of the trench. He intended to go straight through the curb but the street superintendent would not permit it and he went around it. The sides of the trench were left vertical and no shoring was installed. City employees entered the hole, made a connection at the sewer main and laid one or two lengths of pipe. It was understood that the plaintiff would lay the remainder of the tile and the city employees instructed him as to the grade he should maintain for proper drainage. Shortly after the city employees left the scene plaintiff entered the trench, laid a few tiles and then a portion of the trench wall collapsed, injuring him.

The court held that, under these circumstances the city was not liable, as it had no control over the manner in which the trench was dug.

* * *

Course in Basic Radiological Health

A 2-week training course in Basic Radiological Health will be presented at Las Vegas, Nevada, September 11-22, 1961, by the Division of Radiological Health, Public Health Service. The course will cover the basic nuclear physics necessary for a technical understanding of radiological problems in public health work, major sources of radiation exposure, modes of radiation injury, and units and terminology.

This same course will be given at the Radiological Health Laboratory at Rockville, Md., October 23-November 3, at the Southeastern Radiological Health Laboratory at Montgomery, Alabama, December 4-15; and by the Training Program of the Robert A. Taft Sanitary Engineering Center in Cincinnati, Ohio, October 9-20. Address all applications for the course or requests for information to the Chief, Training Program, Robert A. Taft Sanitary Engineering Center, 4676 Columbia Parkway, Cincinnati 26, Ohio, or to a PHS Regional Office.



"BUILT STRONG ...has solid weight to do a good job all year 'round"

This township relies on its 160-hp LW 660 grader to keep roads open all year 'round. Equipped with V-plow and wing, the powerful, 34,500-lb grader is shown "blasting" through deep drift. No matter what the job, or season, you benefit from LW grader's cost-cutting advantages — such as 100% anti-friction drive, 5 to 9 more full-power gear ratios than other graders, full-sweep visibility, handy-reach power controls, and rubber engine-mounts.

That's what chairman for a Wisconsin township says about the dollar-saving performance of its LeTourneau-Westinghouse 660 grader:

"We like our LW grader because it's *built strong* and has the *solid weight* to do a good job *all year 'round*. During winter months it plows heavy snow in the bad places... that is, in drifts of compacted snow. Here you need power and the '660's got plenty! Our neighboring townships tell us that a popular-make grader they've been using just doesn't have the power and weight to handle heavy snow like this."

Covers 33 sq mile area

"We also like the fast work and travel speeds on the '660'. Our township is 33 sq miles, and with the 660 grader you can get to any job *in a hurry!* And it gets the *work done quickly*. The school buses and dairy farmers depend on us to keep these roads open."

"During the 'no-snow' season, we use our 160-hp 660 grader to maintain 29 miles of gravel road — we do that once a week. It also handles ditching, drainage work, and maintains shoulders. In addition, the LW grader is used for soil-conservation work on farms in the area. The '660' completes *twice as much grading work* as our other grader."

Economical to run

"We've never had any repair or service problems on the 660 grader. In fact, we find it's very economical to run. After plowing heavy snow all day, the LW grader used only 25 gallons of diesel fuel."

We will give you complete information and demonstration on the LW grader that fits your needs.

7 sizes, 85 to 190 hp.

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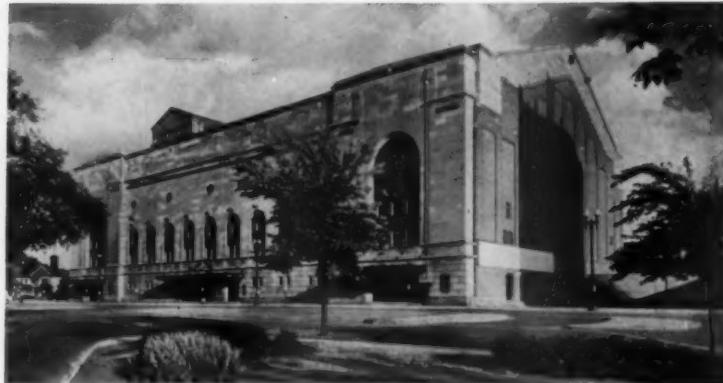
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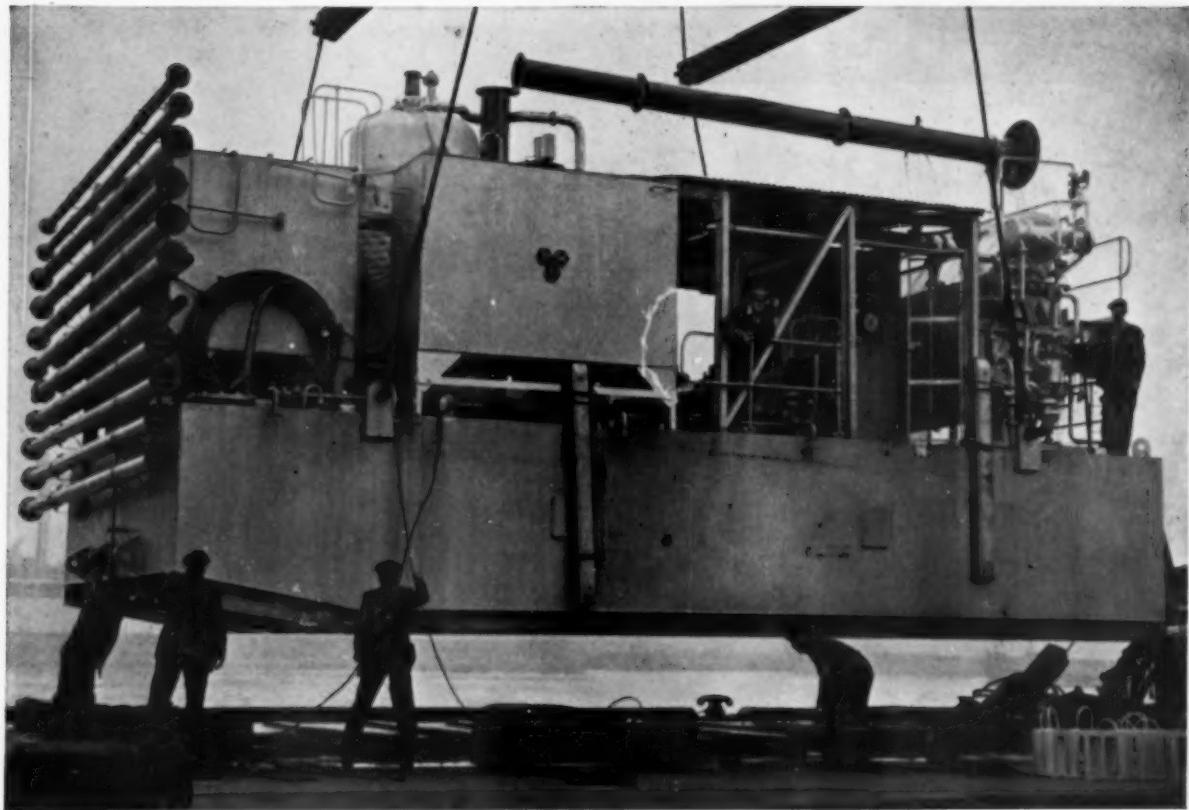
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1313 E. 60th Street, Chicago 37, Illinois**



Packaged Fresh-Water Supply for Abu Dhabi

This is a packaged sea-water evaporator, believed to be the first of its kind, at the start of its long sea voyage to the Persian Gulf. It is now being commissioned and will provide drinking water for the Sheikdom of Abu Dhabi which, with no water supplies of its own, has had to ship it in by dhow at considerable expense.

The unusual feature of this 14,400 gallon per day evaporator is that the whole unit—which includes boiler, diesel generators and pumps—is built on its own water storage tank, which also acts as a pontoon. There are no port facilities at Abu Dhabi and the evaporator was towed inshore a distance of six miles,

then, using its own winch, hauled itself up the beach and on to the concrete foundation prepared for it. When the sea-water supply pipes are connected and the fuel tanks filled, the evaporator will be ready to go to work.

Self-contained plants such as this can be built to any size which can be handled as a unit. They will operate on any normal fuel and the plant can be arranged, as this one is, to produce electric power to drive the ancillary equipment.

We pioneered the development of the vacuum flash evaporator in Great Britain and our experience in this highly specialized field is at your disposal.



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RW84

Variable Speed Pumps for Sewage Lift Stations

BRUCE J. ENNIS

Associate,

Burns & McDonnell Engineering Co.,
Kansas City, Missouri

WHEN a sewage collection system runs out of head due to the topography of the terrain, the location and configuration of new housing and industrial development sites, an increase in the amount of sewage requiring disposal, or the need for establishment of an additional treatment plant or outfall in a specific area not originally contemplated, it becomes necessary to construct a sewage lift station to raise the flow line gradient.

The total head on such a system is composed of the static lift and the pipe line friction losses. In a sewage lift station design, the static lift component is an appreciable amount of the total head required, and friction losses vary approximately as the 1.85 power of the flow. Obviously, the station must be designed to lift the maximum anticipated amount of sewage against the total static head as well as to compensate for the maximum rate head loss in the discharge pipe line systems. If a sewage system's characteristics produced a uniform, un-varying flow throughout each of the hours of the day, the problem of designing a lift station would be resolved by the selection of a constant speed pump to produce the fixed total head required by the static lift and the constant design flow.

Actually, such a characteristic is never exhibited by the average system. In a recent test for a typical small city system, sewage flows were recorded as follows on an average week day:

From an inspection of this tabulation, two factors are evident. One is that the flow varies up and down during the day over considerable ranges. In the two-hour period from 5 to 7 p. m. the flow nearly doubles. In the succeeding two-hour period, it falls off to less than half the amount measured at 7 p. m., and the rate at 8 a. m. is five times

the flow recorded at 6 a. m. The other factor is the great difference between minimum and maximum hourly flows, varying from only 20 GPM at 4 a. m. to an amount nearly thirty times as large at 7 p. m.

To provide for such extremes of flow conditions, it is possible to use a number of constant speed pumps arranged to be started and stopped frequently in sequential control for major flow variations, with a large wet well to equalize smaller fluctuations and reduce the intermittency of pump unit operation. By using a combination of small, medium, and large capacity constant speed pumps, the desired system pumpage rate may be approximated without resorting to uneconomical throttling of the discharge line.

Another method is to use variable speed pumps, automatically controlled to match accurately the desired pumpage rate as it occurs on the system. In this case, fewer pumping units are required, in general, and the size of the wet well may be reduced considerably. Both of these factors tend to compensate for the additional investment required for the adjustable speed motors or drive mechanisms and their control.

Factors in Selection

For any specific set of conditions, the selection of the most desirable method to obtain the required results would depend on economic analyses of the complete lift station

project, taking into consideration the comparative investment required for the constant or variable speed pump units and controls, the cost of the structures, and the relative efficiencies and power costs of the two types of units.

As a general rule, two-speed electric motor driven pumps do not lend themselves to satisfactory application in sewage lift stations. Where the static lift component of the system's head capacity curve is equal to 50%, more or less, of the total head requirements, the pump unit may be expected to put out zero flow if the speed is reduced by one-fourth or more of full rated speed. Since the head produced in the pump varies as the square of the speed, a two-speed motor rated 1150/865 rpm (or 100%/75% speed) would produce only 56% of rated head at its lower speed, and this would be barely sufficient to take care of the static lift, with no residual pressure in the pump unit to offset the friction head losses. In this case, dropping the pump speed from 1150 gpm to 865 rpm would reduce the flow from full rated gpm to practically zero gpm, obviating the necessity for the lower pump speed.

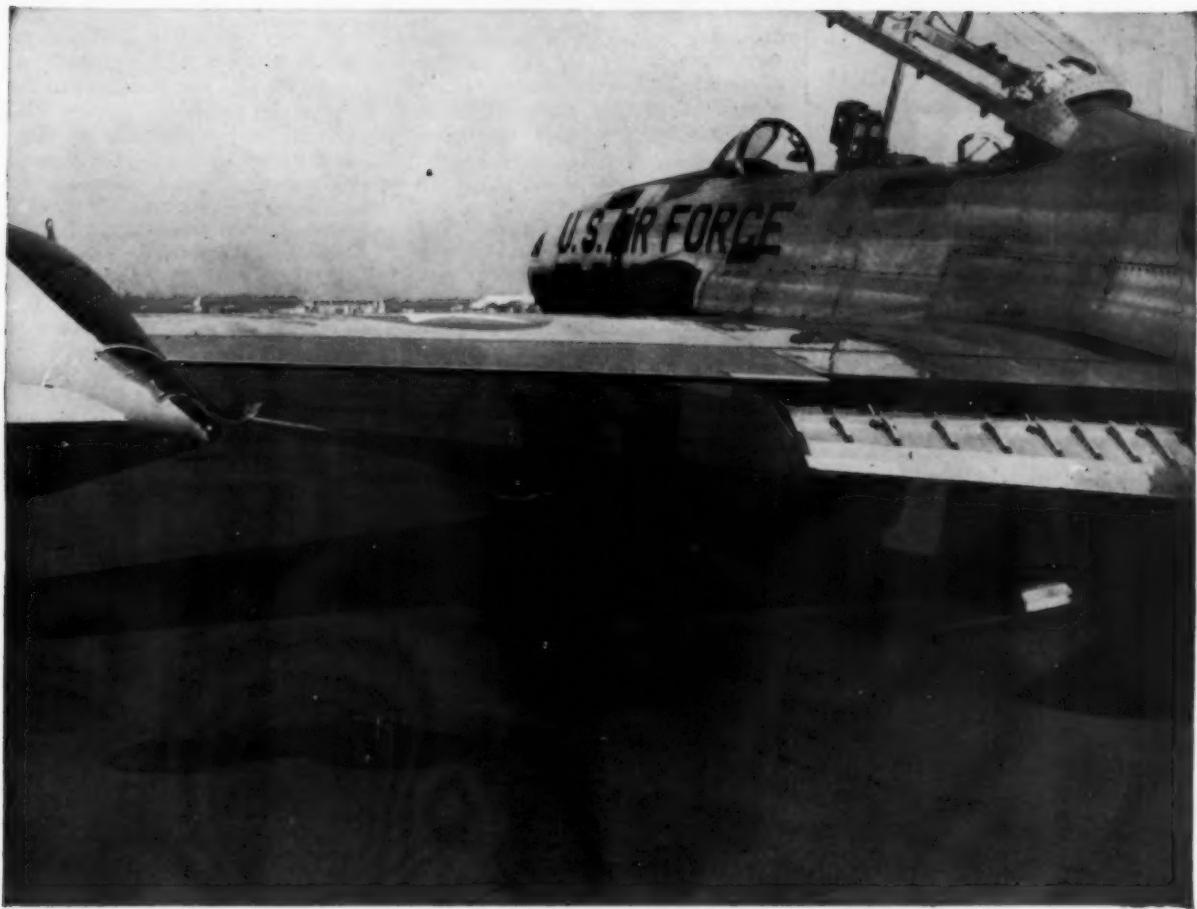
On this basis, and subject, of course, to specific head capacity conditions for individual systems, variable speed drives for sewage lift pumps will usually require a speed reduction of not more than 25%, and this should be provided in a number of control steps in order to regulate the rate of pumpage in small increments.

Electric motor drives for variable speed pumping service are available in several types. Among these are the following:

- 1.) Wound rotor induction motor with secondary speed control of the mechanical rheostat or liquid rheostat type: A wound rotor motor is started at low speed across-the-line, with all secondary resistance connected into the rotor circuit. This limits the inrush current to 100% to 150% of full load current and elimi-

Table 1—Typical Hourly Rates of Flow

Hour	Flow in GPM
8 a.m.	450
9	375
10	550
1 p.m.	440
5	320
7	590
9	260
11	250
4 a.m.	20
6	90



Fuel-resistant Koppers Pavement Sealer ends ramp problem at Scott Air Force Base

The jet age has posed a serious pavement maintenance problem for modern airports: Asphalt ramp surfaces, used for refueling and service work, are extremely vulnerable to deterioration from the solvent action of high grade jet fuel and lubricants.

Scott Air Force Base, located at Belleville, Illinois, has encountered this problem—compounded by mechanical damage from the pivoting and turning movements of jet wheels over the softened pavement.

Maintenance engineers at Scott AFB supervised the application of Koppers Pavement Sealer to give these surfaces a permanent, fuel-resistant cover. Before application of the Sealer, all cracks were repaired, softened areas were cut out and patched, and all surfaces were cleaned with a detergent solution. Two separate coats of Pavement Sealer were applied—13,000 gallons in all—with an appropriate mixture of sand to provide a long-wearing, non-skid surface.

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For more information on how Pavement Sealer can help you solve your pavement maintenance problems, write Koppers Company, Inc., Pittsburgh 19, Pa., or send the

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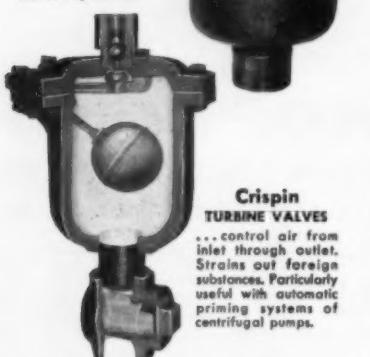
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nates any need for reduced voltage starters. By cutting out the secondary resistance in steps (with a mechanical type rheostat) or in an infinitely variable sequence (with a liquid type rheostat) the speed is increased. When all of the external resistance has been removed from the rotor circuit, the motor operates at full rated speed. At intermediate resistance points, the speed of the motor is controlled to match the desired pump speed in conformance with the required station pumppage rate.

In general practice, the mechanical type of rheostat is manually regulated in steps by means of a reversing motor actuated by a control switch (or by an automatic control system). The liquid rheostat is automatically controlled to cause the motor speed and pumping rate to match exactly the sewage influent rate. Heat is dissipated into air surrounding the resistance grids of the mechanical rheostat. Heat generated in the electrolyte of the liquid rheostat is dissipated in a cooler consisting of a sleeve around the pump discharge piping.

2.) Synchronous motor or squirrel cage induction motor driving a pump through a magnetic or hydraulic coupling: These types of drive units provide infinitely variable speed control and pump output to match the desired pumping rate. The amount of slip in the couplings, which reduces the speed of the pump to the desired value below that of the constant speed motor, is regulated by varying the excitation in the coils of the magnetic coupling, and by varying the oil level in the impeller chamber of the fluid drive coupling.

Large pump units are generally powered by synchronous motors, which permit plant power factor correction, and somewhat higher efficiencies than squirrel cage motors of equivalent rating. Induction motors are usually preferred for small pump units, especially in the higher speed ranges, because of lower investment costs. Depending on the characteristics and capabilities of the plant's electric power supply system, it may be necessary to provide reduced voltage starting equipment for these types of motors in order to reduce the starting inrush currents to acceptable values.

3.) Squirrel cage induction motor driving a pump through a mechanical variable speed unit: For the smaller sized pumping units, this type of drive provides a stepless control of speed by the simultaneous expansion and contraction of

companion sets of V-shaped pulleys, connected by a matching belt, to change the relative diameters of the driving and the driven pulleys. The unit may be mechanically or automatically controlled for the desired speed settings while operating. At full rated speed on the output shaft, the mechanical drive unit will have a power transmission efficiency of nearly 100%. At three-quarter rated output speed, the efficiency might be expected to decrease to 75 to 80%.

4.) Alternating current wound rotor—direct current shunt wound motor combination unit: As the above designation implies, this unit consists of an AC wound rotor induction motor coupled onto a common pump shaft with a DC shunt wound motor. The slip rings of the rotor of the AC motor are connected through rectifiers to the armature of the DC motor. Strengthening the field of the DC motor decreases the speed of the unit and causes the AC motor to slip in speed. The resultant slip power provides voltage to the DC motor through the rectifiers, and driving torque to the pump is contributed by both the AC and DC components. At full speed, the wound rotor motor furnishes 100% of the required torque. At 50% speed, each component furnishes one-half of the required torque. Speed control is infinitely adjustable by varying the excitation of the DC motor field, and the starting characteristics are similar to those previously described for wound rotor motors. This unit provides high efficiency over the entire operating range, but the power factor is approximately 5 per cent less than a standard AC motor.

As compared with constant speed pump drives, the use of variable speed pumps is becoming increasingly popular for sewage lift stations for reasons as follows:

1.) Infinitely adjustable pumping rates are possible.

2.) Fewer pumping units are required for the station.

3.) Smaller and less expensive wet wells are feasible due to pumping at rates matching incoming flow requirements.

4.) Friction head losses in the discharge line are reduced by pumping at normal inflow rate.

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Jay W. Spencer



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*Based on a comparison of latest available manufacturers' suggested retail prices.



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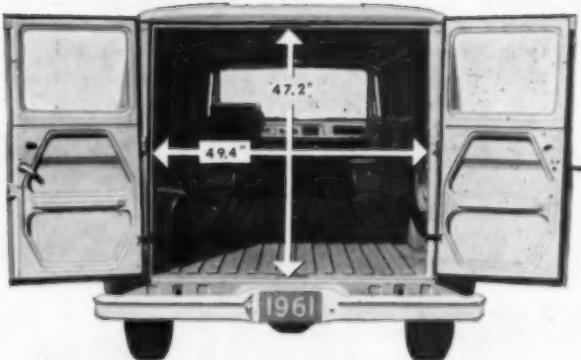
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SAVING ON PRICE—You can save \$312 compared to even the lowest-priced popular $\frac{1}{2}$ -ton panel—and up to \$433 against others! Saving at least.....

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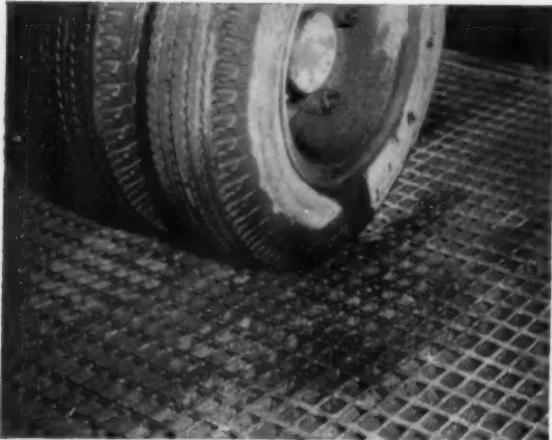
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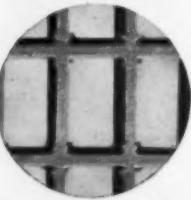
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Ed Cleary Reports on:

"Nuts and Bolts" Aspects of Pollution Control

EDWARD J. CLEARY

Diplomate, American Academy of Sanitary Engineering
Cincinnati, Ohio

THOSE WHO are wearied with the philosophic and technical profundities of pollution control would have received a lift in spirit at the June national convention of the Izaak Walton League in Chicago. The program put together by William Riaski, executive secretary of the League, could be described as a workshop session dealing with the "nuts and bolts" aspect of keeping streams clean.

Purpose of the workshop was to show League members how they might participate most effectively in curbing stream pollution. The League is no newcomer, of course, in this crusade. It has a record of almost 40 years of national activity in this endeavor. But its Clean Waters Committee, under chairman G. E. Condo, Hamilton, (Ohio) attorney and past-chairman, Dr. David B. Charlton, Portland, (Ore.), chemist and engineer, want to see greater emphasis by League members in "riding herd" on local situations. In brief, the committee recognizes that the so-called national problem of pollution is the composite of a series of local problems. Therefore, it is urging concentration of effort on eradication of these individual sore spots throughout the nation.

Before he resigned several months ago, Frank Gregg, then executive director of the League pointed up the opportunity for Waltonians to promote a positive program for clean streams. Said Mr. Gregg: "I'll wager that in more than half the cities wherein we have a chapter the local sewage disposal facilities are completely inadequate".

A Good Example

How an effective job can be done on a local level was set forth by Duke Reed, general chairman of the Cook County (Ill.) Clean Streams Committee. The League chapter joined forces with a citizens group established in 1953 by the Cook County Board of Forest Preserve Commissioners to give practical aid in fighting pollution. This alliance prevailed upon local, state and federal agencies in the county to provide representation at regular monthly meetings. Purpose of these meetings is to focus attention on "sore spots" and promote remedial action.

Members of the central committee regard their task as one of physically identifying and documenting specific cases of pollution, referring these to the appropriate authorities, and then providing follow-up to secure desired results.

The committee consists of a general chairman, an executive secretary, six watershed chairmen (each responsible for one of the areas into which the county has been divided), a legal advisor and a publicity representative. Watershed chairmen report cases found by their group at the monthly meetings. Then



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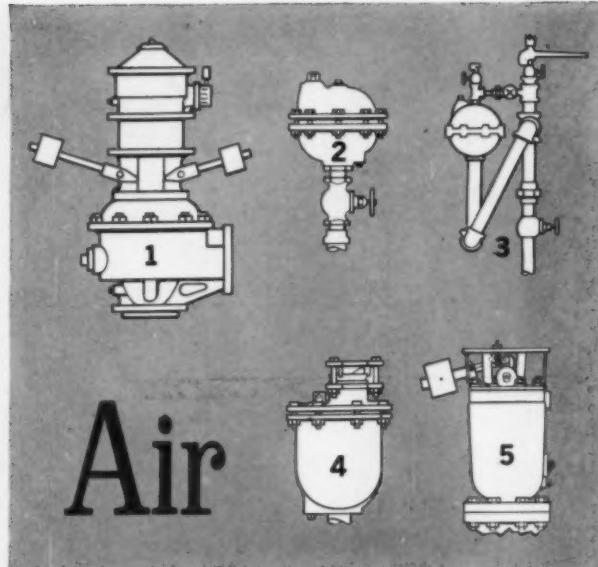
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3 Protects sewage pipelines: Type "B" Air Release Valve, special for lines carrying sewage or sludge, removes entrained air and gases. Special trap catches sludge, prevents fouling of air-release valve. Relatively simple back-flushing cleans out this trap, maintains top efficiency and protection. Valve itself is same as Type AGFD. Details are in Bulletin 1206.

4 Provides three functions: Type AV Air Release and Air Inlet Valve performs three operations, combines great protection and single-unit economy: (1) Automatically releases accumulated air, (2) admits air to break vacuum, and (3) vents pipeline to permit escape of air when filling system with water. Standard units operate to 150 psi. For full details, send for Bulletin 1205.

5 Breaks vacuums: Type VAC Air Inlet Valve solves two serious pipeline problems: possible collapse of pipelines due to formation of vacuums—and stoppage of flow, caused by air binding, when lines are being filled. Standard units have 4" to 10" inlet diameters, can be assembled in groups to do the work of one large, expensive valve. For 16 pages of detailed information, send for Bulletin 1202.

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a determination is made regarding which public agency the matter is to be referred to for corrective action. At these meetings representatives of public agencies are invited to comment on findings and report on progress being made on previously assigned cases.

Field trips are made by watershed-committee volunteers—by boat, by car, by canoe or on foot, according to conditions. The investigators are equipped with maps, report forms, steel tapes, cameras and boots, and a "keen regard for the need to report fully and accurately." In some cases water samples are taken, but this is usually left to paid professionals. A report form was devised to record such information, as the location, rate of flow, nature of bottom, color of water, odor, visible solids, forms of aquatic life, suspected source of pollution, remarks, date, time and names of observers.

In some cases field trips have included point-by-point checks from main streams to ditches and the lifting of sewer tops to determine sources of pollution. Field crews may contact available personnel at suspected or known sources but more often their reports are formally presented to interested public agencies by the executive secretary of the central committee. For example, when an overflow from a combined sewer is found to be polluting a stream in dry weather it is immediately reported to sanitary-district officials to secure prompt action in clearing the obstruction that prevents proper flow to intercepting sewers.

City and community newspapers have been enlisted to expedite corrective action, and this has been most effective in dealing with large corporations who are sensitive to public relations. It has been found useful first to point out improvements that have been made, and then to single out specific offenders as representative of what needs to be done.

Said Mr. Reed: "An advantage in having a Clean Streams Committee of non-professional, non-political and unpaid citizens is that being free of political pressures, they can say what they honestly think to anybody at any time without fear of retribution." And he concluded with this observation: "We feel that public agencies benefit from our support and meet less resistance in doing the job all of us so earnestly want them to do."

Some Further Solid Advice

Supplementing the account of the Cook County group, Vinton W. Bacon, secretary of the Puget Sound (Wash.) chapter, told his fellow Waltonians: "We expect a clean-waters committee to gather facts before recommending action. If we are going to be respected and effective, certain ground-rules command attention." He then recited these four rules:

"First, appoint a committee made up of all interests including those of municipal and industrial dischargers. You'll be surprised how much you can teach one-another in a frank discussion on a friendly basis.

"Second, study your local problems first. The tendency is for us to be wheels and operate on the "big" state and Federal levels. If each chapter handles its local problems well, where it really has a chance to study them, there won't be the need to continue to buck our demands to higher levels of government.

"Third, get the facts and data, apply logic and fairness, draw conclusions, chart a course of action,



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grounds
couldn't
stop this
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The problem:

Installation of 8,000 ft. of concrete sewer pipe running parallel to a creek and below its water level. The problem was complicated by numerous springs and unstable ground conditions so serious as to allow opening the trench for only one or two lengths of pipe at a time.

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and then stay with it. In seeking those facts, inquire of everyone who might inform you, asking precise, pointed questions. If you feel you've gotten the run-around, repeat your request. Don't give up. Persistence itself will respect.

"Fourth, remember respect is earned not inherited with our affiliations. Respect will increase our effectiveness."

Some Professional Viewpoints

Supplementing these how-to-do-it procedures, the Waltonians also heard from some professionals involved in the business of keeping streams clean.

Dwight Metzler, director of the sanitation division of the Kansas State Board of Health, described how years of frustration was overcome in handling the case of a city that saw no merit in abandoning the practice of dumping garbage into a stream. On a hot summer day the officials and leading citizens of the town were invited to a river inspection trip. As the party boat approached the city from downstream floating masses of decomposing debris became evident. Finally the boat reached a point opposite the garbage disposal location and here it was anchored. The stench was so intolerable that the city officials begged to have the boat moved to a more congenial place for discussion. "We had trouble in getting up the anchor" said Mr. Metzler, "but when we did everyone agreed that this garbage dumping would be halted pronto."

Some Hoosier advice on promoting support for local bond issues was given by Oral Hert, sanitary engineer of the Indiana Stream Pollution Control Board. Pointing out that not all citizens were conservation-minded, he urged that Waltonians emphasize the overall community benefits to be derived from proper sewage treatment and not simply dwell on the benefits to fish life.

Glenn R. Schultz, assistant cashier of the Continental Illinois National Bank and Trust Co. of Chicago, reminded the Waltonians that "voters are people"—and people don't encourage municipal spending unless they are convinced of the benefits that will accrue. He then outlined techniques for winning citizen approval on sewage-treatment bond issues. "Watch out", he said, "about bringing in outside speakers to overpower the local residents. Small communities in particular resent outsiders that appear in the role of telling them what to do."

An Action Program For All

From this workshop emerged a host of ideas that could be applied by many organizations who are seeking to do something concrete about pollution control. And it was made abundantly evident that the time is long since past to rest the case for clean streams on such palliatives as, "there ought to be a law" or "we need more time and money to study the problem."

In brief, it could be concluded: (1) We don't need more laws on preventing pollution; but we do need more aggressive enforcement of present powers; (2) we are not handicapped by lack of technical know-how because we have not yet fully applied what we already know; and (3) public agencies who are conscientiously trying to curb pollution are undermanned and need the moral support of organized citizen groups. These are the "nuts and bolts" aspects of pollution control that were emphasized in the workshop sessions of the Izaak Walton League.

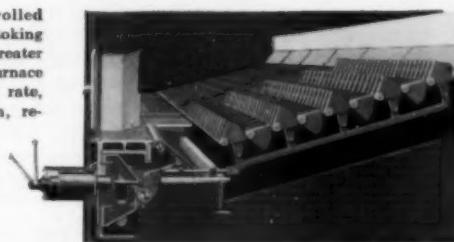
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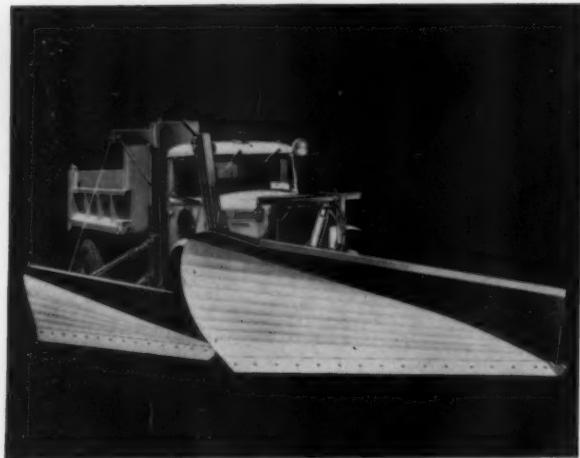
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New Frink 430-S and 440-S (8' and 9' cleared widths) one way plows offer new design features that give increased performance and more efficient snow removal. The result of two years development and testing, these newest Frink plows are designed without deflectors, utilize regular 400 Series drive frame and trip mechanism for greater parts standardization.

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Cost of Laying Water Mains and Sewers

The joint report of the Auburn, Me., Water District and Sewerage District for 1960, gives cost data on installation of water and sewer mains. Lyndall K. Parker is superintendent of both districts. The Water District laid 10,716 ft. of 2 to 12-in. pipe. On 10 jobs, involving 6-in. cast iron, cement-lined mechanical joint pipe, with lines from 166 to 2045 ft. long, costs varied from \$1.88 to \$3.19 per foot when ditch was furnished; and from \$2.97 to \$4.72 for contract work covering the entire job. Two jobs of 8-in., 576 and 710 ft. long, cost \$4.68 and \$4.24 per ft.; and one job where ditch was furnished, cost \$3.59 per ft. for 500 ft. For 12-in., the cost on one job 1210 ft. long was \$8.14 per ft.

On 8 sewer jobs, 8-in. diameter, cement-asbestos pipe, ranging from 181 ft. to 976 ft. long, cost \$2.28 and \$2.47 where ditch was furnished; \$2.46 to \$4.34 for the complete job; one line 450 ft. long with "considerable ledge" cost \$5.56 per ft. One 10-in. line 688 ft. long with "some ledge" cost \$4.11 per ft. Two large lines were built, both reinforced concrete. A 60-in. section 920 ft. long cost \$60.07 per ft., and a 66-in. section 396 ft. long cost \$77.18 per ft.

Cost of Water Mains in Toledo

Water mains constructed in Toledo, O., in 1960, totalled 23,070 ft. of 6-in. at an average cost of \$6.25 per ft.; 2,474 ft. of 8-in. at an average of \$7.26; and 182 ft. of 12-in. at \$12.00 per ft. For the 6-in., materials represented 50.4 percent of the total, pavement restoration and labor 24.4 percent, hauling and equipment, 12.8 percent, supervision and overhead 7.4 percent and engineering 5 percent. For 8-in. pipe the percentages were 47.5, 22.0, 15.8, 7.2 and 7.5. For the 12-in. percentages were 57.8, 14.1, 14.7, 8.3 and 5.1. On the 6-in. pipe the lowest cost job was \$4.41 per ft. and the highest was \$8.08. The low on the 8-in. was \$6.36 and the high (of two jobs) was \$8.15.

Resanding Filters at Springfield

During 1959 two slow sand filters were resanded at Springfield, Mass. Filter No. 4 required the removal of 1,540 cu. yds. of sand and the placement of 3,080 cu. yds. of clean sand to restore the filter to the desired depth of 44 ins. For cleaning, handling, removing and replacing the sand it was necessary to use 1,440 gallons of water per cubic yard of sand handled. Filter No. 14 required the removal of 596 cu. yds. of sand and the placement of 2,100 cu. yds. of clean sand to restore the filter to the depth of 44 ins. For this work about 1,680 gallons of water were required per yard of sand handled. Peter C. Karalekas is Chief Water Engineer and M. J. Shaughnessy is Superintendent of Water.

Amebiasis in the United States and Canada

According to a study reported in the March, 1961, issue of the American Journal of Tropical Medicine, it is estimated that less than one percent of the population of Alaska and Canada and less than 5 percent of the population of the United States harbor *E. histolytica*. The study covered data reported in 166 surveys on nearly a quarter of a million persons. Previous estimates of 10 to 20 percent infection were found to be too high because many surveys were of groups expected to show a high prevalence of infection and because of the inclusion of *E. hartmanni*.

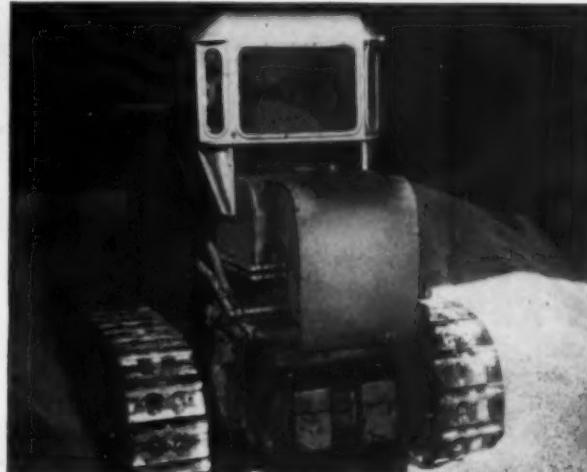
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with mixes based on Columbia Calcium Chloride

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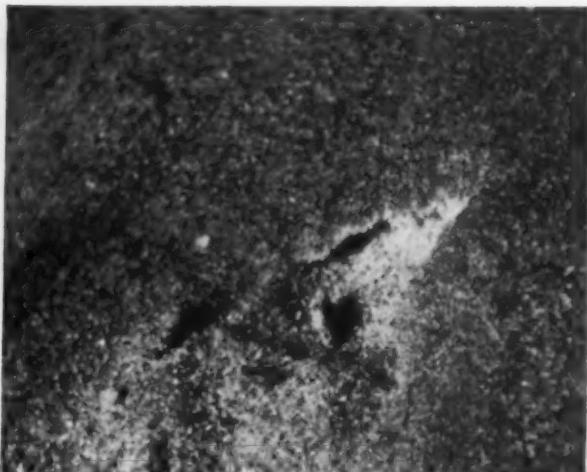
1. On a well-drained asphalt mat, dump rock salt and Columbia Calcium Chloride (generally two or three parts salt to one part Calcium Chloride).



2. Mix and blend thoroughly with front-end loader, when both salt and Columbia Calcium Chloride are dry.



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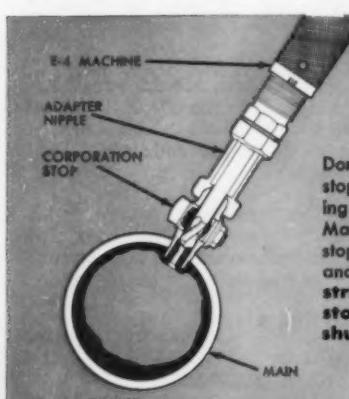
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500 p.s.i. at 100°F.
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*Just follow
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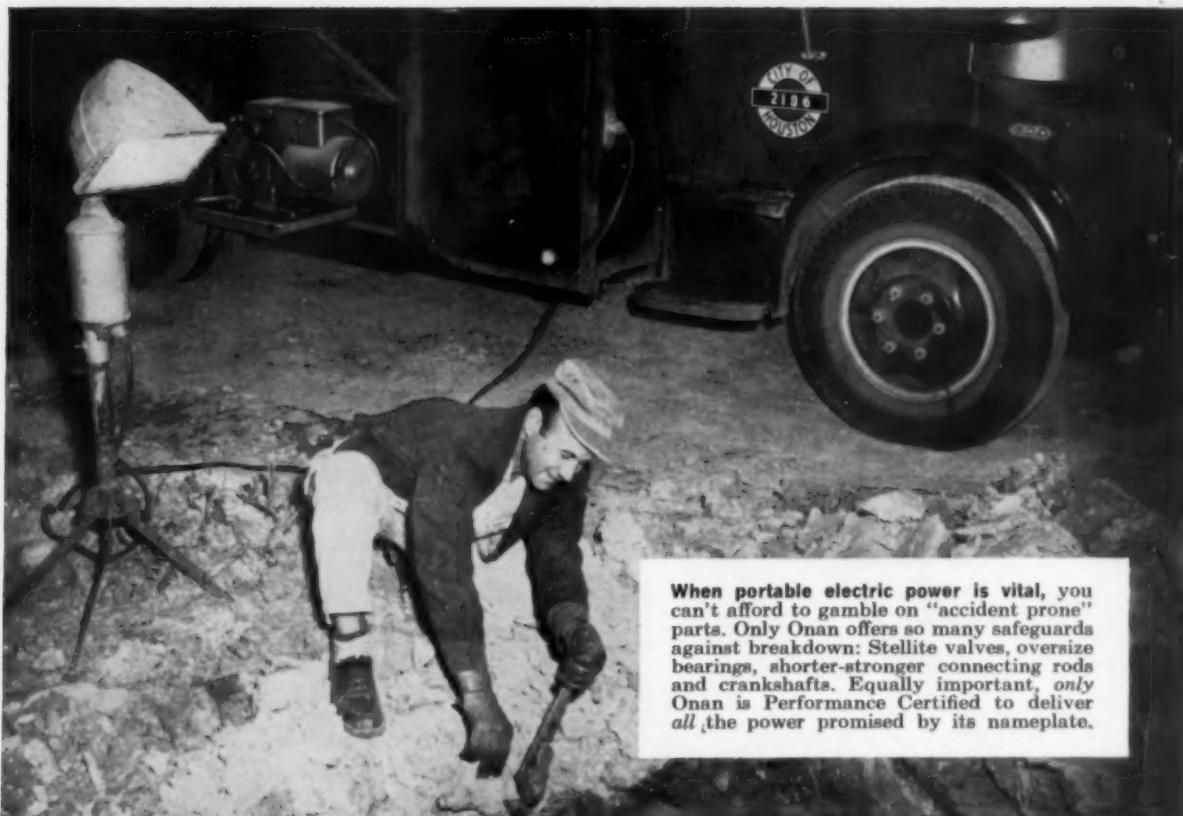
- 1 Bolt a Mueller Service Clamp to main in desired position.
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- 4 Advance drill through both open stop and clamp and drill into main.
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TRENDS IN WATER CONSUMPTION

PUBLIC WORKS
Volume 92, Number 8
AUGUST, 1961

THE INCREASING awareness of the public of our national water problem is likely to focus attention on water consumption data and any reasons for reported scarcities. In an effort to update information on municipal use and current trends toward increasing rates of use, the editors of PUBLIC WORKS conducted questionnaire studies involving solicitation of data late in 1959 and again in 1960 and 1961. A similar but more restricted survey was made in 1956 with the results published in the December, 1956 issue of PUBLIC WORKS. Those have been compared with the more recent studies.

What Water Use May be in 1970

Late in 1960, a questionnaire sent to more than 4,000 water works engineers and superintendents asked for per capita water consumption in 1950 and 1960 and an estimate of what the average consumption per person would be in 1970. Nearly

1300 questionnaires were returned; however only the first 669 returns received were used as a basis for this study. This number is adequate since experience has shown that inclusion of additional replies does not change overall figures.

Of the 669 questionnaires studied, 465 or slightly over 10 percent of the total mailed provided what appeared to be reliable data. In a few cases, the question asked appeared to be misunderstood or replies were in a form that could not be used, as total mgd or use per tap. These were eliminated from the averages.

Here is what the latest water use study showed:

In 1950 average use was reported as 107.7 gpcd; the 1960 use was reported as 134 gpcd; and the estimated 1970 use is 158 gpcd.

These figures show an average annual increase in water consumption of 2.5 gpcd for the 1950-60 period and an estimated increase of 2.4 gpcd for the ten years to 1970.

The study made by the Editors of PUBLIC WORKS in 1956, involved data obtained from city water departments, consulting engineers and state sanitary engineers, though it involved a much smaller sampling than the current study. Analyses from 27 selected cities showed past, present and estimated future consumption figures, as follows: in 1936, 109.5 gpcd; in 1946, 124 gals.; in 1956, 139.5; in 1966, 157 gals.; and in 1976, 170 gals. Figures were also given on maximum daily and maximum hourly uses. The study showed an annual increase in per capita use daily of 1.45 gallons in the 1936-1946 period; of 1.55 gallons in the 1946-1956 period; estimated 1.75 gallons in the 1956-1966 decade; and of 1.30 gallons from 1966 to 1976. These estimates indicated a tapering off in the rate of increase after 1966.

It will be noted that the consumption data reported in 1956 showed somewhat higher usage on a national basis than that reported

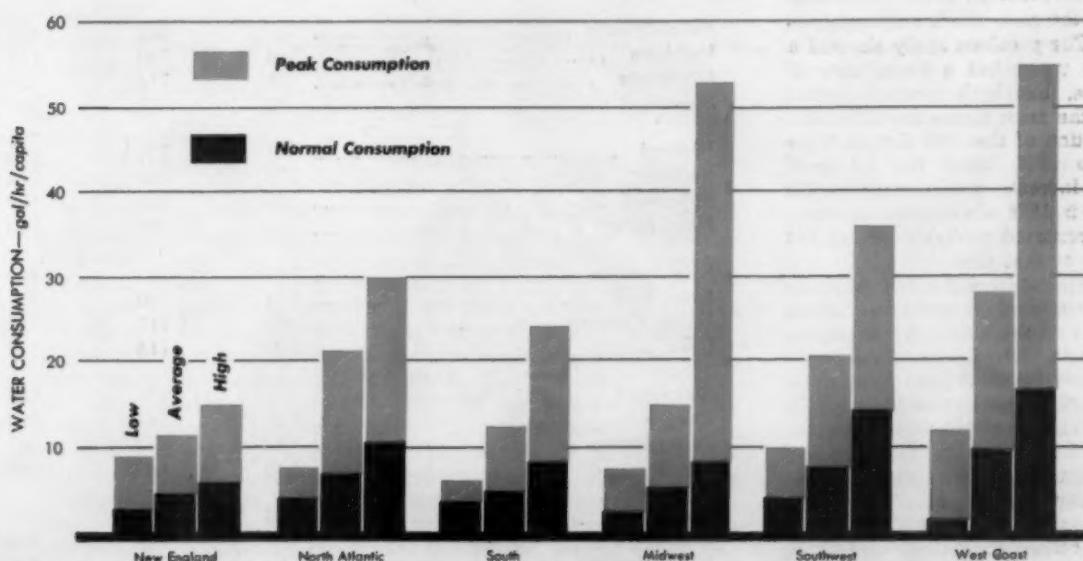
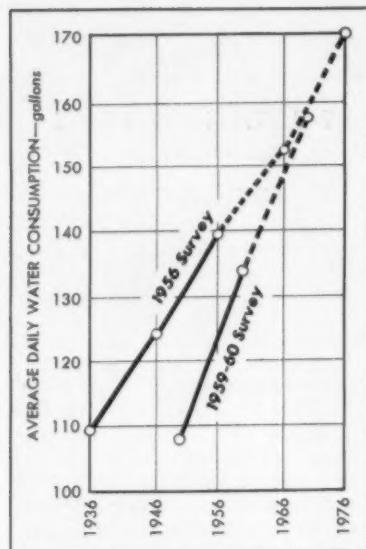


CHART of normal and maximum hourly use of water shows variations reported by different geographical sections.



RECENT studies exhibit conflicting data on water use, possibly due to greater emphasis on water conservation following widespread severe shortages.

in 1960-61. There are no data to indicate which is the more reliable, nor to provide any reasons for choosing between the two sets of figures. Possibly after the epidemic of water shortages of a few years ago, additional metering programs were initiated and leak location and repair emphasized. There seems no doubt that many cities became extremely water conscious and imposed new water use restrictions.

In any case both sets of figures show that the increase in water usage has occurred at an accelerated rate in the past, which may not continue. The previous study showed a greater usage but a lower rate of increase, but both studies predict about the same figure for 1976. Extrapolation of the 1961 figures from 1970 to 1976, using the 2.4 gpcd annual increase, produces about 172 gallons in 1976 whereas the previous study reported probable use at 170 gallons at that time.

The replies from the 1960-61 study were separated by states and totals of some of the states are shown in the accompanying table. Though replies were received from all but one state, only those states from which five or more replies were usable are included in the table. For purposes of comparisons and to establish the reliability of the figures, geographical areas were compared. The five states considered fairly typical of the nation as a whole, because they are located in typical areas—Alabama, Iowa, Minnesota, Ohio and

Washington—were compared to the national average. This comparison showed them below the overall figures with 99 gpcd in 1950, 121 gpcd in 1960 and 148 gpcd estimated for 1970. However, the rate of increase in water consumption closely paralleled the national average.

The New York and Pennsylvania replies are from 50 cities (23 in New York and 27 in Pennsylvania). These included three large cities in none of which rates were out of line. The three Pacific Coast states are considerably above the average; an average usage of 211 gpcd is predicted for 1970.

Restrictions on the use of water were also reported by a relatively few cities—54 in all; the great bulk of these represented limitation on water use by air conditioners.

Hourly Rates of Water Consumption

Information on average and maximum rates of water consumption in gallons per hour was obtained from 114 typical cities through a 1959 questionnaire. The hours when such peaks occurred were also reported by most cities. A summary of the information follows:

Two peaks, morning and afternoon, were reported by Birmingham, Ala., with average hourly consumption at 4.13 gals. per capita, with a peak of 6.19 gals. Winslow and Yuma, Ariz., showed average hourly uses of 9 and 8.1 gals., respectively and evening peaks of 14 and 19.5 gals. De Queen, Ark., reported a peak at 11 to 12 AM of 14 gals.,

(Continued on page 180)

Table I—Average Water Usage Per Person Per Day in 32 Selected States

	1950	1960	1970
Alabama	93	112	125
Arizona	190	178	215
Arkansas	64	114	141
California	150	191	267
Connecticut	116	125	139
Florida	153	193	183
Idaho	168	201	239
Illinois	104	107	143
Indiana	96	122	147
Iowa	77	103	129
Kansas	110	125	138
Kentucky	75	103	133
Massachusetts	87	106	132
Michigan	108	142	173
Minnesota	91	116	137
Mississippi	70	91	105
Missouri	81	100	125
Montana	138	199	215
Nebraska	108	153	199
New Jersey	74	99	114
New Mexico	109	131	153
New York	114	140	151
North Carolina	60	118	157
Ohio	100	115	143
Oklahoma	81	121	149
Oregon	161	184	202
Pennsylvania	94	118	141
Texas	130	165	190
Virginia	83	101	118
Washington	157	188	245
West Virginia	93	112	132
Wisconsin	112	130	157



A New Approach to

Sewage Treatment Expansion

M. CARLETON YODER

Consulting Engineer,
Berkeley, California

THE CITY OF VACAVILLE, California has adopted an ambitious program to stimulate industrial growth with the expansion of sewage treatment facilities a primary step. The existing treatment plant was approaching its maximum loading and its location was enclosed by areas zoned residential, industrial and commercial. The potential industrial areas considered as part of the Vacaville Planning Area are to the east and southeast of the present corporate limits and could not be sewered to the existing treatment plant by gravity. It was therefore indicated that any plant expansions would involve the ultimate relocation of the treatment plant.

The principal industrial firm in the city is Basic Vegetable Products, Inc., and their principal operation at Vacaville is onion dehydration. The odors from the onion waste are, of course, present in the sewage but the problem of odors at the treatment plant are multiplied many times since the mixture of this waste with domestic sewage causes a sharp increase in the rate of sulfide production. The consideration of odor control was also a deciding factor in favor of plant relocation.

The plant site, which appeared to satisfy all of the needs of the city, was four miles southeast of the present corporate limits. At this lo-

cation the entire Industrial Park area could be sewered by gravity and treated effluent could be discharged into Alamo Creek adjacent to the plant site. There was, however, one problem created by the selection of this site. The community of Elmira (several hundred population) was less than one-half mile to the west and several residences were located along Alamo Creek.

Consequently, the plant, itself, had to operate without producing odors. The odor in the incoming sewage had to be controlled, and the discharge to the creek had to be completely stabilized so as not to produce odors during the summer and fall months when the only flow in the creek would be the plant discharge.

Experience in sewage treatment makes it quite hard to believe that any plant or any process operates completely free of odor. Chemicals and masking agents do an excellent job of relieving the problem of odor control. They were being used at the existing plant but periodically human or mechanical failures would result in odor complaints.

Early in the preparation of the report, prior to design, it was realized that something new and different was needed here. A process termed "Rated Aeration" by the Chicago Pump Company and otherwise known as "aerobic digestion" or "total oxidation," was being promoted for small treatment plants as being low in first cost, simple in

operation, high in degree of treatment, and completely odor free. Its application, they believed, was economically limited, however, to plants of 0.5 mgd capacity or less. A brief investigation of installations proved the claims of odor-free operation to be remarkably true and thus prompted further studies in the use of this process as well as its sister processes of standard activated sludge and step aeration.

In considering the three processes, it becomes apparent that they are not at all three different methods of treating sewage but, in reality, different modes of operating an activated sludge plant. Simply stated, they differ only in the age of the sludge maintained in the system.

The growth of the activated sludge is an accumulative process. If, on the first day of operation, the total weight of solids leaving the primary tank was one-hundred pounds and the amount leaving the final tank was forty pounds, then obviously sixty pounds of activated sludge must have been developed and retained in the system. If, on the second day, the solids from the primary sedimentation tank were again one-hundred pounds and if that leaving the final sedimentation tank were, this day, thirty pounds, then seventy pounds of activated sludge must have been developed and a total of one-hundred thirty pounds is now retained in the system. As this process is continued, the weight of sludge in the system continuously increases until a prob-

lem exists, which, for this article, we shall call a "population problem."

In any sewage treatment plant the food supply available to the activated sludge organisms is limited by the volume and strength of the sewage. The air supply is limited to the capacity of the blowers. Obviously, under these conditions, there is a limited population which can be maintained in the system, but that population is variable—dependent upon the age of the sludge. In old sludge, less food and air are necessary as cell growth has slowed down and begins to equal the rate of digestion.

If, in the hypothetical plant operation referred to above, after several months of operation the solids leaving the primary sedimentation tank are still one-hundred pounds per day and those leaving the final sedimentation tank are now only ten pounds per day and by testing we find there are four-hundred and fifty pounds of solids in the system, then we calculate that, at the rate of ninety pounds increase per day, it takes five days to accumulate four-hundred fifty pounds of solids and the sludge age is five days. (While this is not technically correct, it will serve our purpose here.)

If this plant has been operating for several months and now only has four-hundred fifty pounds of solids, what has happened to the balance which should have accumulated at the ninety pounds per day rate? Assuming that four-hundred fifty pounds was the optimum population for this system, ninety pounds per day would be wasted

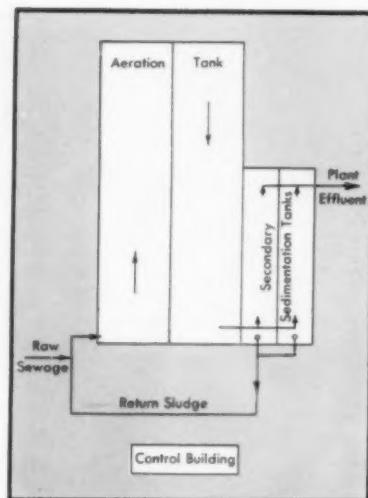
by return to the primary tank for disposal to a digester.

In aerobic digestion, a 24-hour aeration period is provided. The primary sedimentation tank is eliminated and no sludge is wasted. An excess of air is provided so that now the population is limited not by its air supply but by the supply of food. The rate of cell growth theoretically equals the rate of digestion and a natural balance of population is established. Theoretically, the organic material in the sewage has been totally oxidized or aerobically digested. This is not actually possible, but it is to the extent that about 85 percent of the biochemical oxygen demand is removed, or 85 percent of the organic material.

In the standard activated sludge process, the aeration period is shortened to about six hours. A primary tank is used and primary effluent mixed with return sludge is fed into the head end of the aeration tank. Wasting of sludge to the primary sedimentation tank is practiced and the sludge age is maintained at three to five days. Biochemical oxygen demand removals by this method are normally about 95 percent.

The aeration period in step aeration is shortened (two to four hours), the sludge age is maintained at one and one-half to three days and sludge is wasted to the primary sedimentation tank as in the standard activated sludge process.

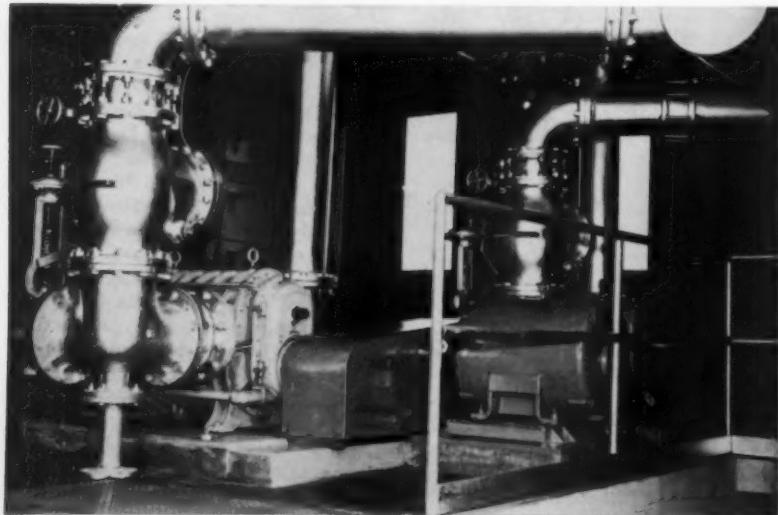
To shorten the aeration period again means this method must be more efficient than standard activated sludge and is not simply be-



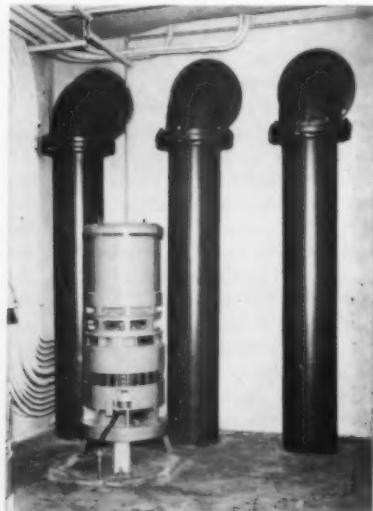
• FIRST STAGE of plant construction provides 1.25 mgd capacity and utilizes the aerobic digestion operating method.

cause of the younger sludge. In the standard method, the return sludge is given one meal a day, at the head end of the aeration tank. In step aeration, the return sludge is allowed to rest, and into the first one-fourth of the aeration tank return sludge only is introduced. At the one-quarter point, approximately one-fourth of the total flow is added and again, at the one-half point, approximately one-half of the total flow. At the three-quarter point, the remaining one-fourth of the total flow is fed into the aeration tank. BOD removals by this method are normally about 95 percent.

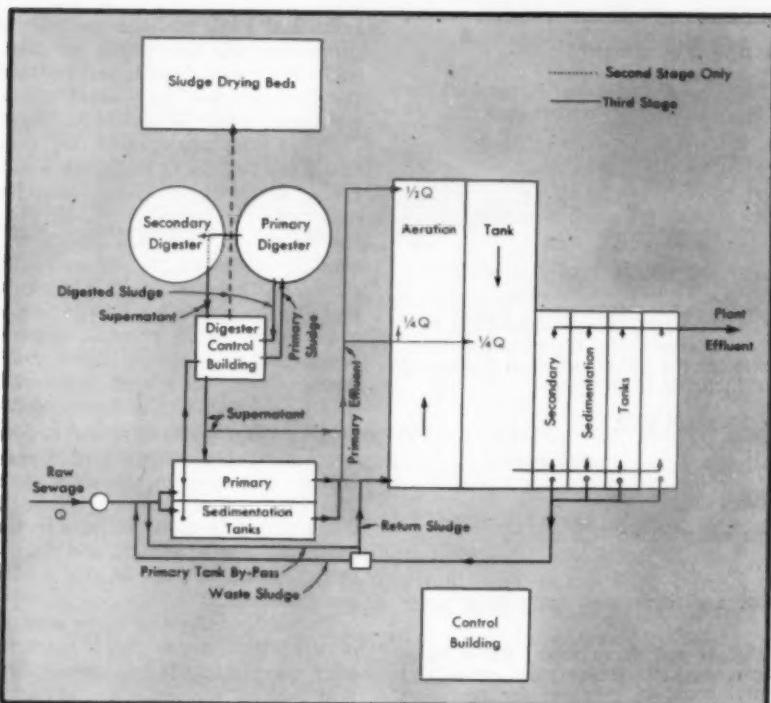
Since there is no primary tank or anaerobic digester in this system, there is no possibility of producing



• TWO blowers, each with a capacity of 2600 CFM, provide aeration for the sewage through 24 swing diffusers with precision diffuser tubes. Treatment results are good.



• MOTORS for raw sewage lift station are 40-hp variable speed magnetic clutch.



● SECOND STAGE units (black outlines) use standard activated sludge process to provide 3.75 mgd capacity. Addition of third stage units (color lines) will change plant operation to the step aeration method and will increase capacity to 5 mgd.

the foul-smelling gases which are normal by-products of anaerobic decomposition. The only possible source of odor is that of the incoming raw sewage. In small treatment plants this does not become a problem since the collection system is short and sewage arrives still containing oxygen.

At Vacaville, the odor of the incoming sewage was to be considered,

however, and several methods of control were incorporated into the design:

1) The wet well in the lift station would be essentially eliminated by the use of variable speed pumps.

2) Ventilation of the wet pit could be accomplished by discharging the exhausted air below the water surface of the aeration tanks.

3) Return sludge could be recirculated into the incoming sewer at the wet pit.

4) Oxidation pond effluent could be recirculated into the incoming sewer upstream from the wet pit.

In addition to controlling the odors of the raw sewage, the plant discharge had to be sufficiently stable to insure against odors downstream during periods of dry weather. With removals of 85 percent of the BOD, oxidation ponds of reasonable size could be depended upon to operate aerobically at all times and produce an effluent that would not cause odors when discharged into a dry creek.

Plan for Plant Expansion

While control of odors was a prime consideration in the design of the Vacaville plant, it was not the only basis for selecting the aerobic digestion method of treatment for the first stage of construction.



● PUMPS for raw sewage, one to five mgd each, driven by motors shown left.

Since this method of treatment is a mode of operating an activated sludge plant (as is step-aeration) it immediately became apparent that here is a potential of flexible plant expansion which warranted serious consideration, yet it had never been utilized in plant design.

The first stage of the Vacaville plant uses the aerobic digestion method of operation. The initial design flow is 1.25 mgd. Raw sewage enters the aeration tank mixed with the return sludge. The scum which would normally be removed in the primary sedimentation tank is removed from the final sedimentation tank and recirculated to the aeration tank. All of the distribution channels for the final stage of construction (step aeration) have been provided. The aeration tank represents the total volume that will be required in the ultimate stage. No additions to equipment nor tank volume will be required. The final sedimentation tanks represent a volume sufficient for a flow of 2.5 mgd. In this stage, no process control is necessary and operation is resolved principally into maintenance of mechanical equipment and housekeeping.

During the first stage, the existing plant is still in service and the combined capacity of the two plants is 2.5 mgd. The new plant receives the design flow of 1.25 mgd which is diverted from the head works of the old plant. At present the total daily average flow to the two plants is 1.8 mgd. The old plant will not be abandoned until growth in that area dictates the necessity of doing so.

The total power cost of operating the first stage design flow is \$750 to \$800 per month. The city, thus far, has found it possible to offset this relatively high cost by saving in labor, as no addition to the operating force has been found necessary.

The structures built and the equipment supplied in this stage represent an estimated 40 percent of the total cost of the ultimate 5 mgd plant. While the first stage cost was slightly more than that of a more conventional plant, nothing is wasted, and every plant feature is an integral part of the ultimate plant. Considering increasing construction cost, the added expenditure is an investment on which savings will be realized in the second and third stages.

In the second stage the mode of operation is changed to that of a standard activated sludge plant. The capacity can be increased to either

Summary of Facilities and Equipment

Comminution:	One 24" Model "C" Barminutor. A channel is provided for the installation of a second machine as well as a by-pass channel.
Lift Station:	Two 8-in. vertical open shaft pumps with 40 hp magnetic clutch drives.
Grit Removal:	One aerated grit chamber with grit removal equipment. Two tanks, each 185' x 30' x 15' SWD.
Aeration:	Twenty-four Chicago Pump Company Type B-1 swing diffusers with Precision diffuser tubes. One Super Clean air filter. Two 100 hp Standardaire blowers. One water spray system for controlling foam in each tank. All distribution channels for the ultimate design (including channel aeration) were included in this stage.
Final Clarifiers:	Two tanks, each 96' x 18' x 10' SWD. Two Jeffrey sludge collectors. Four sludge withdrawal slip pipes. One Indianapolis 12" air lift. One Wemco scum pump.
Metering:	One 18" parshall flume and Foxboro flow meter.
Ponds:	Seventeen acres of oxidation ponds.
Plant Water Supply:	One deep well, pump, and hydro-pneumatic tank water supply system.
Control Building:	30' x 38', which includes: machinery room, motor room, pump room, screening room, bath, locker room, office and laboratory and a control panel with spaces for all future equipment.

2.5 mgd, by adding one primary sedimentation tank and one digester, or to 3.75 mgd, by adding two primary sedimentation tanks, one final sedimentation and one digester. If the old plant is abandoned in this stage, the expansion would be to 3.75 mgd; otherwise, only to 2.5 mgd, in which case, the combined capacity of the two plants would be 3.75 mgd.

In the third stage the mode of operation is changed to that of a step aeration plant and the capacity increased to 5 mgd. If the second stage included two primary sedimentation tanks and three final

sedimentation tanks (for a flow of 3.75 mgd), then only one additional final sedimentation tank and one additional digester will be necessary in this stage. The channels provided for split distribution of the primary sedimentation tank effluent to the aeration tanks will be used at this time.

Operation Experience

The new Vacaville plant was placed in operation in June, 1960. The new plant has satisfactorily treated a flow varying from 0.80 mgd in the winter to 1.50 mgd in the summer. As development of the

Industrial Park and the community progresses, the flow to the old plant will be increased while maintaining the flow to the new plant at its maximum rate. When both plants are operating at capacity, the second stage will be constructed. Table 1 shows operating report sheet for the month of February, 1961. Analyses are on grab samples. The "final" effluent is discharged to oxidation ponds. BOD removals prior to treatment in the ponds have been in the order of 90 to 95 percent, and no complaints from the residents along Alamo Creek have been registered. A solids balance has been established within the system and it does not appear that wasting of sludge will be necessary in this first stage. The color of the mixed liquor is black, due to organic sulfides in the industrial waste. Settling and clarification characteristics of the sludge are excellent.

Throughout the first seven months of operation, there have been no odor complaints. It has been found that either recirculation of pond effluent or return sludge to the incoming sewer completely controls the odor of the raw sewage. Even in the wet pit area, the odor level is tolerable to the most sensitive nose.

The construction cost of the first stage was \$543,000. The contractor was Osborn Construction Co. of Redding, Calif.

The Vacaville plant probably is the largest aerobic digestion plant in the world today. It will not remain as such, however, as the progressive attitude of the city, by displaying its faith in the science of sanitary engineering, has precipitated a design capable of changing its character with the inevitable growth which must result from forward thinking.

Table 1—Sewage Treatment Plant Operation Record for February, 1961

Date	D.O. Aer. Tanks	Mixed Liquor % Settled 30. Min.	Mixed Liquor Suspended Solids, mg/L	Sludge Index	5 Day BOD, mg/L		Suspended Solids, mg/L		Settleable Solids		Final Effluent D.O., mg/L
					Raw	Final	Raw	Final	Raw	Final	
9	5.9	31	8956	34	...	..	402	9	10	T	6.7
10	..	..	..	..	..	..	..	..	..	..	..
11	6.0	31	..	..	..	..	471	3	20	T	7.2
12	6.8	30	..	..	157	2	104	15	9	T	7.6
13	6.9	30	8625	35	187	3	..	..	8	T	7.9
14	6.6	30	8377	36	..	..	294	15	9	T	7.7
15	6.4	32	8701	35	183	3	286	4	9	T	7.3
16	6.2	31	8585	35	217	3	..	..	9	T	7.4
17	6.3	34	..	..	175	4	360	21	14	T	7.3
18	4.5	33	..	..	127	4	312	20	17	T	7.0
19	4.2	34	..	..	..	..	174	54	18	0.1	6.8
20	6.2	30	8524	35	..	..	..	..	20	T	7.2



WINTER MAINTENANCE

Long before the frost begins to signal the approach of another winter season, plans and procedures must be formulated to provide effective snow and ice control on our streets and highways. The fascination and the challenge in this program lie in the inevitable variation in the problems faced in each new storm—compounded by the heavy traffic now using our road system without regard for season. The promise and the hope in this worrisome responsibility lie in the improved equipment, materials and techniques being developed to meet these needs. The articles that follow in this and subsequent issues offer examples of sound responsible programs employed to provide this important public service.

HOW CINCINNATI CONTROLS SNOW and ICE

CARL V. GAILEY

Superintendent,
Highway Maintenance Division,
Department of Public Works,
Cincinnati, Ohio

IN METROPOLITAN centers such as Cincinnati, where there is a high concentration of traffic, extreme efforts must be exerted to keep this vital flow moving. Traffic loads continue to increase; recent counts have shown that some of our main arteries are used by as many as 40,000 vehicles per day. During the peak hours under ideal conditions on a clear dry day, a minor collision or stalled vehicle creates a bumper bedlam; add snow, sleet, or freezing rain and you have the ingredients for king-size traffic jams.

The City of Cincinnati, located in the extreme southwest corner of the State of Ohio, is in a metropolitan area of over one million people; the city itself has a population of over one-half million. It is located along 23 miles of the north bank of the Ohio River and extends northward eleven miles. The central business district lies in the relatively flat basin area with highly

industrialized valleys extending to the north and northeast. These business and industrial areas are surrounded by Cincinnati's famous seven hills. The city occupies an area of approximately 77 square miles with a widely varying topography. The street system is made up of 877 miles of paved streets, some of which have grades up to 21 percent, and a large percentage of main thoroughfares range between 4 percent and 8 percent. Numerous bridges and viaducts span ravines, water courses, railroads, streets, and more recently expressways.

Weather conditions in the Cincinnati area are such that we have frequent snowfalls; however, relatively few result in heavy accumulations and daytime temperatures frequently moderate to hasten the melting effect of chemical treatment. Snow plowing and snow removal operations are not required, although slush clean-up from the central business district is a regular feature of snow and ice control operation. The principal operation of our program consists of chemical and abrasive treatment to control snow and icy conditions.

Preparation for snow and ice control involves year round activities. In the spring, equipment must be dismantled, cleaned, repaired, painted and stored. During the summer, steps must be taken to procure new equipment for the ice control work; routes are revised to meet the changing needs of the operation; and 1600, 55-gal. ice control containers are reconditioned and stored. In the summer and fall, contracts are entered into for the purchase of materials and rental of contractor's equipment. In late October and early November, training is scheduled to insure the efficiency of the snow and ice control operation. The men are brought in on rainy days for "skull sessions" and thorough training which includes the actual use of materials in dry runs through yard areas. All equipment is given a maintenance and operational check in final preparation. Stock piles of material are made ready and supply yards are put into operation.

Organization

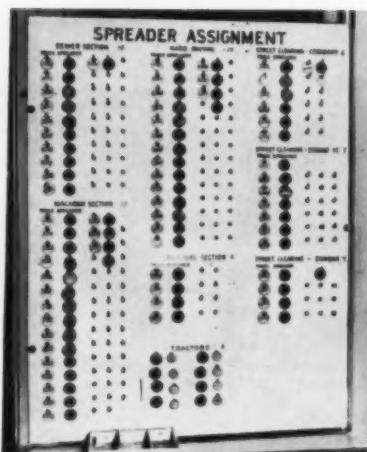
The maintenance organization which performs the task of snow

and ice control is made up of a day force consisting of four operating sections and an equipment section, each under the direction of a section supervisor, and a night force, operating under the street cleaning section. The equipment section also operates a communications center. The overall operation is controlled by the assistant superintendent from a centrally-located field headquarters.

The night force is organized on the first Monday of December and consists of a foreman, four truck drivers, and 12 laborers who are transferred from the street paving operations to the night street cleaning operation. These men work from 10:00 P.M. until 6:30 A.M. and supplement the year round mechanical sweeping operations of our street cleaning section. Their regular duties consist of cleaning alleys, traffic islands, and other locations inaccessible to motor sweepers; emptying litter cans; refilling salt and sand containers; and other miscellaneous work. Their schedules are adjusted so that some of the night street cleaning personnel are working on each of seven nights of the week.

The primary reason for the winter organization of the night force is to provide manpower during the hours when most slippery conditions occur, to ready equipment, and to control the snow and ice condition until such time as it is determined that day men must be called to supplement the effort. The night street-cleaning foreman is in charge of this operation and his observations are of prime importance in deciding the ice control operation.

This foreman uses the communications center office as his headquarters so that he may have all available information on approaching snow storms. When such a storm is forecast as being imminent, he keeps watch on the situation by accumulating information on the severity and path of the storm. He has men patrolling the city in radio cars. If spotty ice conditions develop, his men are immediately available to take care of them. In many cases where bad driving conditions are fairly certain to develop, he has salt spread on the main thoroughfares, especially hills, bridges and viaducts in advance of the approaching storm. If the condition develops to a point where it is beyond his control or, if reports indicate that the snow storm will occur in the early morning hours, he contacts the assistant superintendent and conveys all available information to him.



EQUIPMENT board shows trucks available at any specific time and immediate location by use of color tags.

The assistant superintendent then activates the day forces in the following manner. He calls the five supervisors and outlines the method of operation for the particular situation. The supervisors, in turn, contact their men on a prearranged system whereby telephone calls are divided between foremen to expedite the overall callout. The supervisors of the operating sections are responsible for specific areas of the city which are generally adjacent to material supply locations. Supply yards, located at seven strategic points throughout the city, contain stock piles of salt and mixed materials and loading equipment.

Program Operations

Each section has routes for ice control operations that are arranged in sequence to provide first service to primary streets, thence to secondary or through streets, and finally to residential streets within the assigned areas. 225 miles of streets are listed in the primary routes and 350 miles in the secondary routes. The remainder are in the third and fourth residential routes. The routes are typed and mimeographed, showing locations, termini, time out, time in, and instructions on methods of treatment. These forms are reproduced in ample quantity so that during a storm operation each truck driver is given a portion of the route to follow as his written orders. The foreman assigning the drivers to the routes marks the time out and time in on his master copy, which becomes a permanent record of the day's operation.

The operating procedure for the primary streets was designed to give

immediate treatment to bridges, viaducts, steep grades, and locations known to be hazardous. The treatment procedure is determined by time of day during which the snow or ice occurs. If conditions develop in the morning, the inbound lanes are treated first; if in the afternoon, the outbound lanes are treated first. Snow and ice conditions in Cincinnati are seldom alike. The entire operation is kept very flexible so that treatment can meet the needs of each varying condition. Cincinnati's weather pattern will not permit hard and fast rules of procedure, but requires the good judgment of those controlling the operation.

To handle the many decisions involved in treating a snowfall, our operation requires close cooperation between all sections. The communications center plays an important role in coordinating the overall operation by providing two-way radio contact between personnel in the field and the assistant superintendent, by receiving reports from citizens and by gathering weather information. During the winter months, the center is on a 24-hour, 7-day week surveillance.

Weather information is of prime importance in making decisions regarding the ice control operation. Information is obtained from the United States Weather Bureau by way of a teletype machine located in the communications center. The Weather Bureau offers good coverage of weather conditions throughout the Cincinnati area. The routine forecasts are given at 5:30 A.M., 10:00 A.M., 5:00 P.M. and 10:00 P.M. daily. During the winter season, special warning bulletins are given whenever approaching weather threatens to create hazardous driving conditions. The Bureau also issues a "Highway Outlook" snow advisory bulletin at 3:00 P.M. each day, indicating expected snowfall during the following 24-hour period. Additional information as to the severity of approaching storms is gathered from various state police agencies in Ohio, Kentucky and Indiana by way of the Cincinnati police radio. The collection of this information is a valuable aid to the assistant superintendent in arriving at his decisions. The highway maintenance two-way radio system provides on-the-spot information as to local street conditions.

In connection with the operation of the communications center, the highway maintenance dispatcher has designed two systems for efficient control of spreader equipment and

radio cars. The equipment board reflects the number of trucks available at any one time and their immediate disposition. This board lists the truck equipment number, spreader equipment number and by use of various colored tags a constant tabulation is maintained showing the spreader and truck assignment by section, whether the spreader is attached, out of service, or being repaired. The radio car board indicates by electric lights whether the radio equipped vehicle is in or out of service. It includes the radio call number, equipment number, and name of the operator.

Equipment and Materials

Equipment for snow and ice control includes 70 trucks and spreaders, 12 loaders, seven small tractor snow-pushers, a motor patrol grader, six snow plows mounted on heavy trucks, one rotary snow blower, two truck-mounted cranes, and three bulldozers.

The trucks have dump bodies with three to five cubic yard capaci-

ties and a G.V.W. rating of 16,000 to 24,000 pounds. The spreaders consist of 52 hydraulic type, produced by the Century and W-K Manufacturing Companies; two engine-driven type, produced by the Hercules Manufacturing Company; ten engine-driven blower type for salt only, manufactured by the Tarrant Company; and six electric motor-driven spinner type for salt only, manufactured by the Spin-Zit Company. The loaders include bucket and front-end types manufactured by Haiss, Hough, and Case.

Materials used in ice control operations consist of salt, sand and crushed cinders. We prefer the use of straight salt to obtain a bare pavement and to eliminate the undesirable aftermath of abrasive treatment. The snow removal problem has practically been eliminated in the downtown business area by repeated salt treatments throughout the snowfall. Straight salt is used exclusively in this area. In some snow storms where temperatures are favorable and the snow accu-



mulation is not too heavy, we are able to control the entire situation by using only salt. Conditions do not always permit the use of straight salt and we then use mixtures of one part salt to four parts of abrasives.

Public Relations

Public relations play an important part in our ice control operation. An administrative employee of this division has been assigned to provide complete public information releases to the press and radio. It is the policy of the division to offer information without waiting for the press or radio to seek it out. As part of this program and to the mutual benefit of the division, we cooperate in making road condition reports by telephone tape-recording to six Cincinnati radio stations. In our reports, we ask cooperation, give advice, explain what is being done, and generally inform the motoring citizen what they can expect when leaving for or returning from work. Current reports are aired throughout the duration of each snow emergency. We find that good public information pays dividends in fewer calls from citizens, a better public understanding, and favorable publicity by the press and radio.

Snow and ice control operations are financed from state gasoline and motor license taxes. The allocation for this work is considered in our appropriation of funds for street repair and, while no specific amount is set aside for ice control, the sum of \$350,000 is reserved for this purpose. In the event of an unusually severe winter, the ice control service is provided without regard to the amount appropriated.

While our average annual expenditure for snow and ice control is approximately \$350,000, of which \$30,000 is for actual snow removal, the 1960 expenditures were as follows: Snow and ice control labor, \$265,000; material, \$180,000; equipment, \$45,000; total, \$490,000. Snow removal labor, \$54,000; material, \$2,500; equipment, \$3,500; total, \$60,000. The ice control figure includes the cost of cleaning up abrasives after treatment. Material cost in ice control includes \$135,000 spent for approximately 9,000 tons of salt.



● SNOW removal operations last February showing plow and truck spreading salt.



● LOADING salt and sand for application to snowy and slippery streets. Note the use of space under the viaduct for salt storage and use of modern loading equipment.

A BORDER STATE'S WINTER BATTLE

J. H. McWILLIAMS, JR.
Maintenance & Equipment Engineer
Delaware State Highway Department
Dover, Delaware

THE LOCATION of the State of Delaware with respect to latitude and proximity to the Delaware Bay and Atlantic Ocean contributes to the unpredictability of weather conditions. The state is 100 miles in length from north to south and a maximum of 40 miles in width with topographical features which vary widely. Rolling hills and ridges to the north bordering Pennsylvania gradually give way to almost perfectly flat lands in the southern half.

Weather conditions usually vary widely from one end of the state to the other. The northern half is usually the recipient of heavier snowfalls and lower temperatures but this is not always the case. The situation is frequently reversed when storms move in from the south. Yearly variations in weather conditions are equally as unpredictable. During the winters of 1950 to 1952, snowfall was so light that it caused no concern; however, from 1958 to 1961, the story was different. New records were set from prolonged cold, wind and snowfall during the past winter.

In Delaware, the State Highway Department is responsible for every mile of public highway, including major arteries through towns and cities, and 380.87 miles of suburban development streets outside of corporate limits. Each type of highway, from the dualized DuPont

Parkway to the rural dirt road has its respective place in the snow removal operation. The state system totals 4,148.86 miles. Delaware consists of three counties, each coinciding with one division of the department. Each division is primarily responsible for two separate phases of operations, maintenance and construction. However, where necessary, the personnel and equipment of the construction section are utilized to augment maintenance forces in the snow removal program.

Equipment

Types of equipment used and methods of operation depend on local conditions. The three divisions have a total of 153 dump trucks of 1½ to 4-ton rating, all of which are equipped with straight plows. Thirty trucks can be equipped with V-plows in case they are needed and 21 are also normally equipped with mechanical end-gate spreaders. Assigned to the northern section of the state are 18 Walters and FWD 4-wheel-drive dump trucks; equipped with both straight and V-plows; in addition there are five rotary-type plows. Three of the rotaries were acquired during the past year through the government's surplus equipment program. Of the 31 motor graders assigned to the three divisions and used for snow removal

al, 8 are equipped with V-plows. Most of the graders are based in the southern end of the state where they are used extensively in the maintenance of dirt roads, the majority of which are located in this area. When equipped with V-plows and chains, the graders become very effective snow fighters during the winter months and eliminate the need for special snow fighting equipment which could be used only on a seasonal basis.

Probably the most valuable addition to the snow removal operation in this state is the two-way radio system which was installed five years ago. Although only the more vital pieces of snow fighting equipment are equipped with radios, the supervisors, patrol cars and various headquarters so equipped find it invaluable for general communications and emergency situations. There are 158 radios in use regularly during snow removal operations. By exchanging receivers, the Maryland State Roads Commission in Baltimore and our State Highway Department in Dover have been able to report storm conditions to each other by radio at any time of the day or night during the past winter. This has proven of great value in keeping track of storms which usually affect both states.

Chemicals and Abrasives

The use of chemically-treated sand has been standard practice through the state for many years, for hills, bridges and intersections. Sand from state-owned borrow pits is stockpiled in the fall of each year at strategic locations. Calcium chloride is mixed at the rate of 50 lbs. to the cubic yard by truck cranes with clam shell buckets. The stockpiles are "sweetened" by placement of a layer of calcium chloride over the pile after mixing. This method of storage has worked very well with the exception of periods of heavy precipitation followed by extremely low temperatures, which do not occur often. Small front-end loaders, truck cranes and Gradalls



● A TOTAL of 153 state-owned trucks are available for snow plowing; 18 are four-wheel drive. There are also 31 motor graders. Two-way radio is rated "most valuable."

are stationed at sand storage points to load trucks. Rock salt is used in limited quantities and is applied by several methods. A combined total of 40 mechanical end-gate spreaders and truck-mounted hand-fed motor-driven spreaders, plus two of the 5-ton bin-type, are used. The use of salt is governed primarily by budgetary limitations.

Planning Procedures

In late summer and early fall, equipment is readied. This involves the repair of plows and experimental improvements. Meetings are held in each division, at which time personnel are given assignments for the coming season. New procedures are outlined, the most common sources of trouble discussed, and definite instructions given. The operators are provided with maps outlining their particular routes. Since there is not enough equipment for simultaneous coverage of all roads, a system of priority scheduling has been introduced recently and seems to be quite effective. It involves the assignment of "A" and "B" routes. "A" routes are primaries and especially vital routes which must be cleared first. "B" routes are secondaries and the less important routes which can wait until the "A" routes are cleared. During plowing operations personnel are instructed to stay on "A" routes until it has been determined by supervisory personnel that those routes will remain open. Then orders are given to shift to "B" routes. In case of drifting, equipment can be easily shifted back to "A" route schedules.

Divisions hold equipment inspection in October. At this time all snow removal equipment is checked for readiness with plows and attachments mounted. Lights, windshield wipers, plows and all inci-

dentials are checked and the division graded accordingly. Staff personnel accompany the division engineer and the results of inspection are made available to all divisions.

Snow fence is used extensively in Delaware, most of it the conventional wood-slat type. Some aluminum panel fence has been used with good result but it is more expensive and requires special handling and storage. Last winter 67.43 miles of fence were erected throughout the state.

Actual Operations

During the winter months, weather reports are received twice daily from two U. S. Weather Bureau Stations, one located in the northern part of the state and one in Baltimore, Maryland. When reports indicate snow, plows are mounted at the end of the work day in preparation for a call during the night. Plows are also mounted Friday evenings in case of snowfall during the weekend. Each division engineer is responsible for alerting crews as he deems necessary.

Each piece of equipment is pre-assigned and, when called, proceeds on its assigned routes. In addition, all radio-equipped vehicles, whether regularly assigned to the maintenance or construction section, are assigned areas for patrol. These units are the communications links with headquarters. They not only report conditions in the field but also are used to re-route equipment, check complaints and emergency calls, and to contact mechanics or wrecker units.

In case of local storms affecting only one or two divisions, the staff maintenance engineers may supervise the temporary transfer of equipment and personnel from the division least affected to others where needed.



The department facilities are augmented in case of severe prolonged storms by contractor's equipment, usually dozers, heavy loaders, and motor graders. Relative to equipment rental, the procedure now used is as follows: Prior to the winter season, equipment rental rates are established by the Department for the various types to be engaged; contractors are notified of the rates and requested to indicate what equipment they will make available at the indicated rates. Only equipment thus contracted is engaged if needed. This procedure has eliminated disagreements over varying rental rates charges by different contractors in different sections of the state.

Major Problems Encountered

In spite of all the planning and preparation for snow removal, problems continue to arise which require special attention and continual changes in procedures. The demands of the traveling public must be met as nearly as possible. Some of these demands can be countered only by a program of education to the problems confronting the department. Probably our greatest source of complaint is the private driveway which is repeatedly blocked by the plow each time that it passes, a situation that cannot be remedied until all roads are cleared and widened.

Emergency calls for assistance in opening roads and drives for doctors, ambulances, etc., have been prevalent, although not always legitimate. In case of doubt we have requested that the caller have the doctor or state police make the request to headquarters.

The department is not allocated specific maintenance funds for snow removal operations as such, due to the fluctuation in total costs from year to year. However, expenditures for the winter of 1960-61 totaled \$736,000, exclusive of new equipment. If the border State of Delaware is to remain as it has for the past several years on the northern side of the ledger as far as snow is concerned, a considerably greater slice of the maintenance dollar must be directed to that operation.



● NEW METHODS for combatting snow are constantly being tested. Here workmen are erecting metal panel snow fence—a fall job done in co-operation with farmers.

MILD WINTERS STILL REQUIRE PLANNING

MYRON D. CALKINS

City Engineer,
Tacoma, Washington

IT MAY SEEM a little facetious to report on the problems of snow and ice control in an area of the country where snowfall, although not actually a rarity, comes so seldom that regular funds are not budgeted on a continuing basis to cope with this problem. This appears to be shortsighted planning at first glance, but on a little deeper analysis and from past experience, it is apparent that this approach is not completely without merit. The City of Tacoma, on an actual weather statistical average, does experience some twelve inches of total annual snowfall. This has developed as an average over an extended period of years, but even this total has not been reached during the past several years of an apparently warmer-weather cycle for the Pacific Northwest. In addition to our limited amount of snowfall, our minimum temperature in January, which is our coldest month, averages just under 40 degrees. Even though we may have short periods of subfreezing temperatures, these are generally limited to a few days duration and, with such assistance from the weather, our snow and ice problems disappear rapidly.

The City of Tacoma has within its borders some 48 square miles of area. Within this area there is a total of 615 miles of driveable streets with an additional 135 miles platted but not now open for travel. Of the 615 miles, approximately 2 percent are included in the downtown business area and the remaining 98 percent is divided into 26 percent arterials and 72 percent residential or access streets. Two hundred fifty-four miles, or 41 percent of the 615 are paved streets with the remaining 59 percent being either an oiled or a gravel surface.

We do have several problems in connection with snow and ice control which are of concern to us and



● TACOMA from the air. Steepest terrain is in downtown area; snow and ice control operations have to be concentrated in this area and on the arterials serving it.



● AVERAGE snowfall is not great, generally about 12 inches, but location close to ocean often prevents adequate warnings of storms, requiring continuous readiness.

which we have attempted to combat on a realistic and planned basis. The first of these is the fact that Tacoma is situated on a portion of Puget Sound known as Commencement Bay, and in the early developmental years of our city, in order to be close to shipping and rail facilities, the largest concentration of industry and business was on the shores of this bay. As the city grew and extended its roots back from the bay shores, the downtown core area naturally developed on the steep slopes bordering the bay. Because of this, our areas of steepest terrain are coincidental with the downtown area which is of highest priority for keeping traffic moving in all types of winter weather. In view of this situation, we have set up a system of priorities in which the primary arterials serving the business center are of first concern. It is understood by our city crews, through directive, and by our business people, that snow and ice control on these streets will be concentrated on in the event such conditions occur. Even though this plan concentrates our traffic on these priority downtown streets when snow does fall, it also limits our activities in the downtown area in order that we can effectively cover arterials in other parts of the city as well. Our directive on street priorities is also issued to all city departments so that the police, fire, civil defense, transit and others are aware of such priorities.

Another way in which we expedite traffic in our congested areas, as soon as snowfall begins to be a problem, is to convert all of our traffic signals to flashing amber for the main direction of traffic flow and flashing red for the minor direction of traffic flow. In this way we eliminate unnecessary stopping and starting in hilly areas where this can be a special problem.

Bridges Get Slippery

One other area in which constant vigilance must be maintained is on our many bridges which cross the rivers and waterways extending inland from our bay shores. Bridges, of course, because of their elevated nature, are the first roadway surfaces to show slippery conditions when the temperature begins to fall.

Even with our limited amount of cold weather, we check these bridge decks nightly throughout the winter season. On frosty mornings, slippery bridge decks can cause many accidents. Accordingly, our night crew pick-up truck, which is actually a roving trouble crew, is

kept equipped with an automatic salt spreader ready for immediate action when such is necessary.

We have a total of six automatic salting machines and six automatic sand spreaders which undoubtedly seems a limited amount of equipment for our approximately 50 square miles of city area. In addition to the winter equipment, we have approximately 20 dump trucks of various sizes, 7 motor patrol graders, 3 power sweepers, 3 mechanical loaders, 4 tank flushers, and an oil distributor. Added to these, of course, we have a number of mowers, pick-up trucks, trailers, etc. Six graders can be used as snow plows, if necessary, and on rare occasions, when snowfall becomes a real problem, local contractors are ready with supplemental blading equipment to assist us on a rental basis. With this type of working arrangement we feel that a sufficient amount of flexibility is built into our operating plan to take care of most emergencies.

Budget Allocations

In regards to budget allocations for snow removal work, it was apparent to us after several years of attempting to set aside sufficient money for any emergency activities necessary, that in view of the extreme limitation of funds under which we must operate, this plan was not feasible. We did however, note that in our summer oiling program, during which city maintenance crews oil seal many miles of city arterials a certain amount of overtime was necessary in order efficiently to conduct that operation. Accordingly, it is now our practice to budget a single sum for overtime and emergency work in our street maintenance account. This is not for snow and ice control as such, but



for emergency and overtime work necessary throughout the year. The portion of this fund, therefore, which must be spent for snow and ice control gives us a rather clear picture of the balance within which we must stay for the remainder of the year in other maintenance programs. This, of course, is not an easy thing to do, but with continuing emphasis on efficiency in these other maintenance programs, we are usually able to stay within our budget allotments. It is true that with this type of flexibility built into our budget, the amount allocated is not a large one, and, if an extreme winter emergency does occur, we then appeal directly to the City Council for a Reserve Fund allocation while the emergency is still fresh in mind.

While these problems may seem minor to those of you who contend with months of continuing snow and ice removal and disposal throughout the winter, it is nonetheless a challenging problem in organization to keep maintenance crews constantly informed and equipped ready for emergency action when problems do occur. One disadvantage in this "banana belt" is the fact that we are located so close to the Pacific Ocean where our winter weather usually originates that advance warnings of unusual weather conditions are many times nonexistent. Accordingly we continue to maintain an attitude of watchful waiting throughout the winter and only begin to breath easier when the month of March is well under way.



● EQUIPMENT as well as men must be ready at all times to meet any storm emergency. To maintain equipment in good working condition, the city has this repair shop.

TECHNICAL PANEL DISCUSSES WINTER MAINTENANCE

AS THE FIRST wet snow flakes of the last winter season descended on Highland Park, Illinois, a group of engineers representing six state highway departments, two toll roads and the U. S. Bureau of Public Roads, gathered there to share maintenance problems and plans as a part of the Winter Maintenance Forum of the Calcium Chloride Institute. The growing importance of modern, effective maintenance practices, the interest of the Highway Research Board in this phase of highway engineering and the experiences of the various agencies which were discussed, are presented here as a timely review in preparing for the approach of another seasonal battle with the elements.

Highway services are geared to our national economy. These services are needed on a year around basis to support our economy and to maintain public recognition and support of the continued highway program. A \$1½ million loss to industry has been figured in the City of Detroit resulting from an one-half hour delay of workers arriving at work. This one-half hour delay during each of the 35 normal storms per year could mean an annual loss of \$50 million to industry. Delays to commercial traffic result in similar losses. Because of the heavy traffic, and the importance of this traffic, it

is believed that the Interstate system should be maintained to standards equivalent to those of present toll facilities. In most cases this will mean upgrading present standards and will require more and better equipment, materials, and manpower. The cost will be high. As an example, average winter maintenance costs on primary roads in Illinois in 1958 were \$256 per mile. Costs on the expressways in the Chicago area were \$2,300 per mile.

The Highway Research Board, organized November 11, 1920, as an agency of the Division of Engineering and Industrial Research, one of the eight functional divisions of the National Research Council, is a co-operative organization of the highway technologists of America operating under the auspices of the Academy-Council and with the support of the several highway departments, the Bureau of Public Roads, and many other organizations interested in the development of highway transportation. The purposes of the Board are to encourage research and to provide a national clearing-house and correlation service for research activities and information on highway administration and technology. The Snow and Ice Control Committee originated in 1944, and issued the first bulletin on this subject. This bulletin was last revised in 1954. There has been much

progress in the treatment of a slippery road with salt and calcium chloride since this time as indicated by papers on this subject presented at recent Highway Research Board Meetings. A new Highway Research Board committee has been formed to study methods of chemical treatment to prevent damage to bridges and pavement surfaces.

In Iowa the history of highway maintenance has been one of expansion. In the 1920's adequate service was provided by plowing snow after a storm. This was followed by continuous plowing throughout the storm, use of abrasives to insure better traction and finally the use of chemicals and equipment for complete de-icing of highways. Justifying the increased budget was a concern during each winter maintenance program change. One of the most effective developments has been the use of chemicals as an agent for de-icing highways.

The Iowa program of using salt for ice control began in 1953. It was small enough to avert any budget problems, but located where a large number of road users could form an opinion as to its worth. The vast majority of opinions were favorable. The program was then expanded to include 3,300 miles or one third of the primary road system. There has been no problem in justifying the economics of program expansion.



● CALCIUM chloride stored under plastic tarp from March to July along Ohio Turnpike is free-flowing under light crust.



● MIXING rock salt and calcium chloride for the New York Thruway. Conveyor belt carries material to stockpile at left.

Experience indicates that the average cost of snow and ice removal with plows and abrasives on two lane Iowa roads is increased about \$200 per mile when they are put in a salting program. Iowa is considering the expansion of the program to include a mixture of salt and calcium chloride. A start will probably be made on the Interstate highways in the Des Moines area.

On the Illinois Toll Road, with the major investment made in the design and construction for the protection of the motorist, it was necessary to approach the immediate correction of hazardous winter driving conditions in a careful fashion. Some of the problems peculiar to snow and ice removal on such high speed, heavily traveled, limited access highways are as follows: 1) Speed is usually greater; 2) it is difficult to impress upon motorists the necessity of adjusting speed to prevailing conditions; 3) entrance and exit ramps must have the same priority as the main line; 4) snow must be removed from the shoulder during all phases of the storm.

The Illinois Toll Road is divided into eight maintenance sections, each with its own building located approximately mid-way in the section, in most cases within an interchange. The equipment is planned to be of sufficient size and number to spread chemicals and/or abrasives on all the main lines and ramps within an hour's time. Salt is used at temperatures upward from 25°F. If the forecast is for lowering temperatures, a combination of salt and calcium chloride is used.

In Michigan there is extreme variation in weather and traffic conditions on the state highway system. Average annual snowfall in the Detroit area is about 35 inches but it increases to 240 inches in the northern part of the state. Traffic on the large expressways in Detroit sometimes reaches 162,000 vpd while it is less than 50 vpd on some other state highways. About one third of the annual maintenance budget is spent for winter maintenance. This amounts to between \$400 and \$500 per mile. However, annual snow removal costs on the Detroit expressway system average about \$5,000 per mile. This work is all done with chemicals.

Wisconsin changed from an abrasive program to the direct application of chemicals on the entire 11,000 mile state trunk system in 1956. The main problems encountered center around equipment, personnel and the public. During the first few years chemicals were

spread with modified abrasive-spreading equipment and shopmade box-type spreaders. The present trend is toward cab-controlled tailgate spreaders. Experienced maintenance personnel often resist change to new procedures and question the effectiveness of straight chemicals compared with the use of abrasives. However, after some experience with the use of chemicals, they can become overly impressed and begin using excessive quantities. There is often early public resistance due to questions about corrosion. When the public does accept this type of program, they become critical if the pavement is not always bare. For this reason district offices in Wisconsin have been instructed not to use the term "bare pavement" program.

The Massachusetts maintenance department is concerned with keeping important expressways open to traffic at all times. This along with the other economic aspects of winter maintenance work resulted in the creation of a new position of "snow and ice control engineer" in Massachusetts. Mr. Robert Lee, appointed to fill this position, has been in charge of experimental use of chloride mixtures on a larger scale than it had ever been done in Massachusetts. The test section was a maintenance area in the central part of the state comprising 98 miles of highways. Some of this mileage carries an average of over 15,000 cars and trucks a day with grades as much as 7 percent. A mixture of one part calcium chloride to three parts salt, by weight, or one to two, by volume, was used on all roads throughout the winter of '59-'60 regardless of temperature. The calcium chloride was dumped from bags and mixed with salt on a bituminous pad. A front-end loader was used for mixing and stockpiling the material. About 1,000 tons of this mixture was made at the beginning of the season and covered with polyethylene covers to prevent adsorption of moisture from the air. The mixture was applied at the rate of about 500 pounds per mile, eight feet in width along the center of each roadway after the start of each storm except in the case of light dry snow at low temperature. After the accumulation of about three inches of slush, plowing operations were started. In the event of heavy, prolonged storms a second application was made in about four hours. For the winter of 1959-'60, costs for the experimental section were \$471 per lane mile against \$494 per lane mile for the entire district. Material



costs are higher but savings are reflected in the fact that less equipment is needed because of the reduced use of sand.

The University of Minnesota began laboratory studies of the melting properties of calcium chloride and salt in 1952. It was basically determined that calcium chloride melted at a faster rate when first applied but that the total amount of ice melted was about the same for calcium chloride and salt. A field study was scheduled for the '60-'61 winter on effectiveness and storage of salt and calcium chloride for de-icing pavements. The objective was to apply a variety of treatments to test sections of an actual paved roadway that had been barricaded to prevent any through traffic. Traffic was to be supplied by state highway department vehicles. Other variables included temperature, amount of traffic, rate of spread, and width of spread.

On the New York Thruway, an analysis of cost data resulting from a two-year chemical mixtures test program in the Weedsport Section arrived at a theoretical chemical cost saving of \$38,299 and reduced chemical quantity of 9,537 tons for the '59-'60 winter, based on projecting the findings of the test section over the entire Thruway. As a result, mixtures were used according to the newly-adopted procedures on the entire Thruway last winter.

Participating in the Forum discussion were: W. D. Dillon, Assistant Chief, Division of Development, U. S. Bureau of Public Roads; H. E. Diers, Engineer of Maintenance, Illinois Division of Highways; F. Smiley, Assistant Maintenance Engineer, Iowa State Highway Commission; R. W. Kress, Maintenance Engineer, Illinois State Toll Highway Commission; H. J. Rathfoot, Chief Maintenance Engineer, Michigan State Highway Department; C. E. Aten, Engineer of Maintenance, Wisconsin State Highway Commission; G. G. Love, Assistant Chief Engineer for Maintenance and Equipment, Massachusetts Department of Public Works; P. Velz, Research Engineer, Minnesota Department of Highways; and L. G. Byrd, Associate Editor, PUBLIC WORKS, who served as moderator.

COLORADO KEEPS THE HIGH ROADS OPEN

MARCH INVADED Colorado this year with a roar that could be heard on both sides of the Continental Divide. Within four days it slammed down 90 inches of snow on Wolf Creek Pass, 10,850 feet high on US 160. It whirled a blizzard at a speed of 50 mph across the broad expanse of South Park, 125 miles to the north, and on into the eastern plains.

Throughout the long days and nights of the maelstrom, only one road was closed: US 40 between Hugo and Limon, 120 miles east of Denver, because of poor visibility resulting from a ground blizzard; on Interstate 70 near Deertrail, 50 miles east of Denver, a gasoline transport jack-knifed and overturned on the highway but the total stoppage amounted to less than four hours.

Although the snowfall throughout the state ranged from a few inches to nearly eight feet on Wolf Creek Pass, the "Road Closed" sign was not posted on any of the 22 moun-

tain passes that the Colorado Department of Highways keeps open throughout the year on the 14 primary routes that criss-cross the Rockies.

Colorado is the seventh largest state in the nation. With 75 percent of all the area in the United States (except Alaska) that is above 10,000 feet high, the department's maintenance men are accustomed to battling blizzards on its 8,518-mile state highway system, where the mountain passes range from 7,834 feet to 11,992 feet in altitude. It is a sizable maintenance chore costing more than a million dollars a year. Traffic never stops. In recent years, week-end traffic counts have soared because of the development of many fine Colorado ski areas. As an example, almost 33,000 ski tickets were sold in one maintenance district during the holiday week, December 26, 1960, through January 1, 1961.

The job of keeping Colorado's roads open and safe for travel falls

to 750 maintenance men divided into patrols, usually consisting of a maintenance man and helper, supplemented by additional personnel on the high passes or during periods of heavy traffic. Each patrol is responsible for a specified mileage. Eight maintenance divisions, each staffed by a superintendent and several foremen, keep the work coordinated and the men and equipment well placed and ready to cope with snow removal problems.

Communication System

A statewide radio and teletype system provides rapid communication for weather and road condition reports. This keeps the motoring public informed and enables supervisory personnel to use their crews where needed and move them as necessary from one location to another. At the department's Denver headquarters, the maintenance and public relations divisions and the state patrol maintain contact with the field and with newspapers, wire services and radio and television stations so that travelers, truckers and skiers will have up-to-the-minute information on road conditions.

Equipment

The backbone of Colorado's snow-plowing equipment, totaling 1,000 pieces and valued at some \$6 million, consists of heavy-duty, four-wheel-drive, diesel-powered trucks mounted with specially-designed 12-foot reversible blade plows. Makes predominating in the heavy-duty truck fleet include Coleman, FWD, Marmon - Herrington and Oshkosh. On the plains and in metropolitan areas, use is made of four-wheel-drive Ford, Dodge, GMC and Chevrolet snow plow trucks. Motor graders with serrated or saw-tooth blades are used on icy surfaces to groove the ice and help sanding operations. Maintenance patrols assigned to the 22 mountain passes use rotary snow plows to widen the roadway and move heavy quantities of snow. The mountain fleet includes Snogo and Bros rotary plows on both trucks and motor



● AVALANCHE control unit of Colorado Highway Department uses an Army howitzer to start snow slides in Fremont Pass (El. 11,018 ft.) at times of lighter traffic.

graders. New Snowblast equipment also was tried recently on several of the highest passes. The multiple-lane design on new construction, along with wider travel lanes and shoulders, has intensified the need for larger plows.

Sanding operations increase in Colorado each year, particularly in the urban areas and on the mountain passes subject to heavy truck and ski travel. Many of Colorado's snow plow trucks are equipped with 12-yard sand boxes and hydraulically-powered spreaders so that traffic following snow plows is afforded good traction. Small trucks with hydraulic spreaders supplement the other sanding equipment. Applications of chemically-treated

sand or cinders are used on the roadway. Stock piles and sand bins containing treated abrasives are located at convenient intervals along the highways to keep the supply constant.

In addition to its regular snow removal program, the Highway Department has carried on an intensive avalanche control program since 1950. Gun crews use 77 mm howitzers, on loan from the Colorado National Guard, to shoot down impending snowslides at times when traffic can be stopped with the least inconvenience. By ascertaining such factors as depth, compaction and moisture content of the snow, temperature, wind velocity and other elements, the maintenance crews are



able to determine approximately when a slide is likely to run. Before the gun crews shoot down a slide, maintenance supervisors assemble tractors, rotary plows and other equipment to handle the mass of snow, trees and rocks which frequently thunder down the mountainside and block the roadway.

Program Costs

Keeping Colorado's highway system open and safe for travel during the 1959-1960 winter cost a record of \$1,227,832, or \$167,892 more than winter maintenance cost during the previous year. Snow removal accounted for \$906,475 of the 1959-1960 total or \$182,404 more than in 1958-1959. Other maintenance expenditures included: Sanding, \$280,100; snow fence, \$14,719; avalanche control, \$13,585; opening waterways, \$11,627; and sand drifts, \$1,325.



● BLADE plow working in Loveland Pass (El. 11,992 ft.) during a typical winter. Snow-fighting equipment totals 1,000 pieces. Multi-lane design requires larger plows.



● SNOWBLAST equipment is especially valuable for the heavier jobs. Here is such a unit cleaning up in the Eagle Slide area of Red Mountain Pass on U. S. Route 550.

Insulation For Highway Bridges Cuts Premature Icing

Chemical research has produced a new type of foam-plastic insulation for highway bridges that may become dangerously icy even when their approach roads are still safe. Many drivers have experienced the uncomfortable sensation of suddenly coming to an icy bridge while driving along an otherwise safe road. When the underside of a bridge is insulated with urethane, it has practically the same rate of heat loss as a road surface. Therefore, it will not ordinarily become iced before the road pavements approaching either side of the bridge. According to Barrett Division of Allied Chemical, one inch of urethane has about the same insulating capabilities that two to five feet of earth provide beneath a road surface.

Costs of Mechanical Street Sweeping and Snow Removal

For cleaning 3,388 curb miles of streets in Waukesha, Wisc., in 1960, by mechanical sweeping, the cost was \$2.27 per curb mile. Per capita cost was 66 cents. For handling 50.1 ins. of snow the per capita cost was \$2.22. Snow removal and salting and sanding were the major items.

Aerial Application of Fertilizer

EARL G. JOHNSON

Special Assistant for

Soil Conservation & Erosion Control,
Atlantic Division BUROCKS,
Area Public Works Office New York,
Department of the Navy

AERIAL application of nitrogen fertilizer solutions at the U. S. Naval Weapons Industrial Reserve Plant, Calverton, L. I., N. Y., has proved a practical, more economical method for promoting erosion control on runway shoulders.

Prior to 1959, ground conditions at the airfield often hampered soil conservation practices during the optimum fertilizing season. The resultant water and wind erosion damage increased maintenance costs and added to already heavy work schedules.

Officials responsible for the maintenance program, report the aerial application of nitrogen solutions has produced remarkable results. The thin stand of creeping red and alta fescue grass, planted during construction, has flourished into a thick growth resisting accelerated water

flow from paved areas. The dense covering of grass has completely checked gullying and rilling, formerly a serious problem on the 700 acres of runway shoulders.

An unexpected dividend was the marked decrease in the amount of sand, grit and pebbles blown on the runways. Daily sweepings of these gritty particles has been reduced from $\frac{3}{4}$ cubic yards to about one gallon per day. This grit factor is important since it means less wear on aircraft engines, particularly jet engines which create a powerful suction.

The aerial application at Calverton was made using the Grumman Ag-Cat, a plane specifically designed for agricultural purposes. A crew of five completed the job in $12\frac{1}{2}$ hours ($62\frac{1}{2}$ man hours) at a savings of \$900 in fertilizer materials annually. The fertilizer solution, Allied Chemical's Uran 30, was applied at a rate of 42.25 pounds of nitrogen per acre.

In 1958, a five-man crew, operating two tractor drawn 10 foot spreaders, was unable to complete the job in four weeks (800 man hours). Soil and weather conditions caused delays and difficulties which

jeopardized the entire maintenance program.

At the request of aircraft officials, the Naval Area Public Works Office, N. Y. had previously studied the problem and recommended a long range soil conservation program calling for semi-annual nitrogen fertilizer treatments. Aerial application, it was decided, would expedite the operation and insure efficient erosion control.

Every six minutes a full cycle was completed. This included filling the plane hopper, take-off, spraying 130 gallons of nitrogen solutions over 10 acres and landing for another refill. Two flag men lined up the 45-foot spray path for the pilot. The only delay was a short wait after every 12 or 13 plane loadings while the truck reloaded at the railroad siding. This proved advantageous as a rest period for the pilot. Aerial application costs averaged \$2.94 per acre where ground application had cost \$5.14. Additional savings in material costs for the aerial procedure resulted in a total cost of \$7.59 per acre, where the ground program had totaled \$11.06 per acre.

In addition to checking erosion, the healthy stand of grass enhances the general appearance of the field, eliminates the expense of repair on eroded areas, eases the maintenance burden and assures a smooth, safe surface in the event of accidental landings on the runway shoulder.

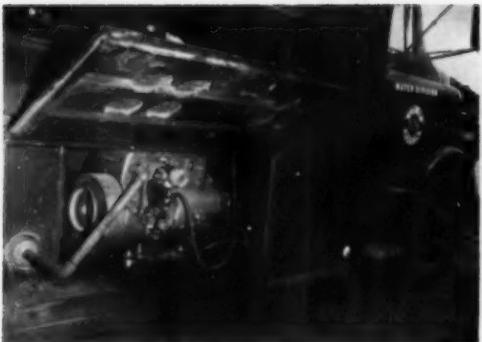
Editor's Note: The opinions in this paper are the author's and do not necessarily represent the opinions of the Navy Department nor the Naval Service at large.



● SIX-MINUTE cycle of operations included filling the hopper of the plane, spraying 130 gallons over 10 acres and landing for another fill.



● EROSION on runway shoulders was reduced materially when a healthy stand of grass was formed.



● GENERAL PURPOSE trucks used by Houston's Water Division carry compact portable generators that provide 110-volt AC for operating equipment and lights plus a DC phase to keep truck batteries charged. The generators are mounted on sliding racks to increase accessibility.

PORABLE GENERATORS Add Versatility to Truck Fleet



● PORTABLE floodlights are quickly connected to an outlet on the vehicle when emergency lighting is needed.

ROUTINE maintenance and emergency repair operations of the Water Division of the Houston, Texas, Utilities Department have been aided by the installation of compact electric generating sets in twelve of the Division's trucks. The Onan AC/DC, gasoline driven generators provide a 30 amp. DC output for keeping the truck batteries charged and 2,000 watts of 110-volt AC for operation of power equipment and floodlights. The DC phase of the generator permits constant use of 2-way radio systems while the trucks are parked at a job site. This also results in fuel savings and minimizes truck engine wear and tear, because use of the truck engine for battery charging is avoided.

For routine repair work the Water Division has sectionalized the distribution system into five districts with dispatching responsibilities vested in district foremen. As

they are pertinent, some jobs are routed through the foreman of the meter shop. Emergency calls are handled via the Division's two-way radio system to dispatch jobs to district and crew foremen.

The truck fleet of the Division includes large and small general purpose vehicles, meter test trucks, and a special vehicle for fire hydrant repair. The equipment is centrally stored and is serviced at the municipal garage, about a mile from the maintenance and meter repair shop headquarters.

Each large general purpose truck has a specially designed body mounted on a 2½-ton chassis. It is provided with a central enclosed compartment for carrying the crew and side bins for supplies and equipment. It is manned by a crew foreman, a maintenance repairman and three laborers. The small truck, with a ¾-ton chassis, carries a crew

foreman and one semi-skilled laborer. These also have special bodies with bins for supplies and equipment.

The meter test truck is a ¾-ton panel vehicle with bins for meter test and repair supplies and equipment. Its principal use is for testing and repairing large meters in the field, and it is equipped with lights and power drilling tools. The special fire hydrant truck, in addition to being equipped with bins for carrying hydrant repair parts, has a power operated boom. It has a 2½-ton chassis.

The generators are mounted for exterior access, but in a compartment equipped with a door for protection from weather and while the truck is moving. The unit exhaust is piped under the chassis. The generators are mounted on sliding racks to facilitate their servicing.

Urban Renewal and Public Works Can Be Partners

ALFRED P. VAN HUYCK

Director of Urban Renewal,
Herbert H. Smith Associates,
West Trenton, N. J.

BY COMBINING public works improvements as part of its urban renewal program, East Orange, New Jersey, is making a significant contribution to the future of the municipality. The result will be the accomplishment of needed public works along with improved housing for their citizens and revitalization of their economy. Like urban municipalities all over the country, East Orange has recognized the potential of urban renewal.

The urban renewal program was created by Congress to eliminate slums and create opportunities for private enterprise to redevelop cleared areas. Since then it has been amended and broadened to include emphasis on the prevention of slums and the rehabilitation of areas not requiring clearance. Normally, private enterprise alone cannot deal effectively with deteriorating areas. The high cost of acquiring blighted properties and clearing the old structures, the difficulty of assembling parcels of sufficient size for redevelopment, and the re-planning and preparing of the site which will often require new utilities, realignment and widening of streets or other public works are usually beyond the financial ability of private enterprise.

The difference between the total project cost and what the redevelopers pay for the site is shared by a two-thirds capital grant from the Federal government and a one-

third contribution from the local municipality. The local one-third share can be paid in cash or in what are called non-cash local grants-in-aid. Many public works improvements are eligible as non-cash local grants-in-aid for urban renewal projects.

As of December, 1960, there were 461 municipalities in the United States that had Federal Capital Grant reservations for urban renewal. Some \$1,731,714,039 has been expended or allocated for all urban renewal activities and the demand for urban renewal is growing every month as communities recognize its potential for solving the problems of blight and obsolescence in urban areas.

The City of East Orange, through the leadership of its Housing Authority, Chairman William J. Sager, and Executive Director, George R. Genung, has moved ahead rapidly with a comprehensive urban renewal program. Its first project, the "Doddertown Area Project" is now in the execution stage. A second undertaking, the Fourth Ward Project, is presently being planned.

The Doddertown Project will cost an estimated \$3,431,329. The re-use of the site will include residential as well as commercial and restricted industrial development. The re-sale of the site is expected to bring a return of about \$614,000. This leaves a net project cost of \$2,816,929, two-thirds of which will be paid by the Federal government and one-third from the city. The municipal share is estimated to be \$938,976.

Nearly one million dollars is a substantial outlay but when it is



● URBAN renewal program permits blighted and obsolete structures like those shown here to be removed and the land redeveloped for new and better uses.

made up from tax credits, the donation of publicly owned but surplus land, and public works improvements the taxpayers get exceptional value for their investment. And it is an investment, as the increased tax revenue from the redevelopment should return the outlay in about six years after the project is completed.

Public works scheduled for the Doddertown project include the construction of a new major thoroughfare (estimated cost \$156,313) to serve as a bypass for traffic presently passing through the project and congesting local streets. This road will be partly in the City of Orange which is undertaking an urban renewal project adjacent to Doddertown. Most of the local streets will be resurfaced, new curbs and gutters installed, old sidewalks replaced where needed and some realignment of the local street pattern will be undertaken to facilitate traffic movement and improve access to property (estimated cost \$92,236).

As a supporting facility an addition to an existing park will be provided to improve access from the redeveloped residential areas in the project.

Flood control measures will be undertaken to correct serious drainage problems of the Second River and Nishune Brook. These two waterways now provide harborage for rodents and often catch debris, adding to the flood problem. Through the urban renewal program the channels will be widened, realigned and deepened, and retaining walls will be placed on the banks of the Second River (estimated cost \$303,-



● FLOOD control measures constitute a part of the Doddtown Urban Renewal Project. The channel of Second River, shown here, will be widened, realined and deepened, and new retaining walls will be built along the sides.

BELOW: New curbs and sidewalks where needed will be constructed.



690). Other public works projects in the area include improvements to the storm drainage system (estimated cost \$6,630), sanitary sewer system (estimated cost \$216,680) and water system (estimated cost \$55,166). The net result will be the improvement of the site facilities to encourage redevelopment and the elimination of undesirable conditions which have plagued this area of the city for many years. Here needed public works done through an urban renewal project will accomplish much more than if undertaken on a piecemeal basis.

The Fourth Ward Project which is now being planned is also a working partnership between public works and urban renewal. In this case the major public works project will be the proposed East-West Freeway to be built by the New Jersey State Highway Department with Federal aid. This major highway facility will pass through Newark and the Oranges. In the Fourth Ward of East Orange it will be possible for the City, through urban renewal, to heal the scars that often occur around such major highways. The re-use plan for the area will provide for the redesign of the street system and the redevelopment of adjacent land uses. Instead of a dislocated neighborhood, with cut-off streets and leftover pockets of development, a new and better neighborhood will be created. None of these advantages would be possible under the present highway program alone.

East Orange is receiving credit for these public works improve-

ments as non-cash contributions toward the City's one-third share of the net project cost. The non-cash contribution is the value of a project improvement or supporting facility that is put into the urban renewal project and is eligible for inclusion in the gross project cost. A non-cash contribution entails an expenditure to construct the improvement or facility equal to the value credited toward the local municipality's one-third share of the project. The improvement or facility is usually necessary in the area whether there is an urban renewal project or not, and therefore creates the opportunity to multiply the effect of the dollars spent. Non-cash contributions do not have to be made by the local municipality exclusively; county or state funds expended on eligible improvements and facilities in the project are also creditable toward the local one-third share.

Non-Cash Grants-in-Aid

A variety of public works improvements are eligible for inclusion as non-cash grants-in-aid for an urban renewal project. The list includes:

Public buildings, such as new or reconstructed kindergarten, elementary, junior high, and high schools; additions to existing schools; district police or fire stations; police and fire communication systems; and branch libraries.

Streets, exclusive of freeways and expressways but including interior streets (completely within the project) and boundary streets (on the

edge of the project); curbs, gutters, sidewalks, traffic lights; bridges, ramps, interchanges, and other similar connections with major highways, when designed and located especially to serve the project; and vehicular and pedestrian overpasses and underpasses. Streets outside the project may be eligible but only when feasibility of the project would be jeopardized without the access provided.

Water distribution facilities, including related items such as booster pumps, fire hydrants, closures of loops and storage tanks.

Sewers and drains, including related items such as lift stations, interceptors and local treatment plants for sanitary sewage as well as storm sewers and drainage structures, including lift stations.

Electric and gas distribution facilities, including related items.

Finished grading and landscaping only when part of an eligible public facility.

Flood control and flood protection works.

Off-street public parking facilities.

Parks and playgrounds which may include land, landscaping, pedestrian walks, lighting, permanently fixed benches and fencing. Those serving residential areas may also include permanent and fixed improvements, such as playground equipment, comfort stations and softball diamonds.

Not all of these eligible non-cash local grants-in-aid will be credited in full. There is an established formula for working out the credits for each project improvement based on the benefit to the project as compared to the benefit to areas outside the project.

When a municipality has areas of blighted structures eligible for urban renewal treatment and there is a need to undertake public works in the area the community can eliminate the blight and carry out the public works in a comprehensive and logical manner to the greater ultimate benefit of the entire community through urban renewal.

Eligibility Requirements

The Urban Renewal Administration, which administers the urban renewal program within the Housing and Home Finance Agency of the Federal government, has set forth the criteria to determine the eligibility of an area for urban renewal treatment. Essentially, the area must be blighted to a degree to warrant public action. The Urban Renewal Administration specifies that 20 percent of the buildings in the area must contain one or more building deficiencies and that the proposed project area must contain at least two environmental deficiencies.

Building deficiencies include, among other, inadequate original construction, inadequate or unsafe plumbing, heating, or electrical facilities, a need for major structural repairs or other defects which, when taken collectively, are causing the building to have a deteriorating effect on the surrounding area.

Environmental deficiencies include overcrowding of structures on the land, excessive dwelling unit density, incompatible mixed land uses, obsolete building types, unsafe and poorly designed streets, inadequate public utilities or public facilities.

There are a variety of urban renewal programs available for different types of blighted conditions. Each of these programs has somewhat different requirements in eligibility and in some cases financing, but all can be used effectively to establish new and better public works improvements.

Conclusions

This is no time to let our great investment in older communities deteriorate by default. Our existing cities are at the core of the new suburbs, and have provided the causes for their growth. Yet all too often the central city is deteriorat-

ing, losing out to the suburbs which it spawned. New industry, new business, and new housing frequently locate outside the older community while that which remains becomes obsolete.

Not only structures, but public facilities become obsolete. Frequently narrow streets need to be widened, water and sewerage systems need to be improved, off-street parking is needed and more park and play space needs to be provided if the older community is to compete with the new suburbs. These public works improvements are essential but their cost is high. To get the highest return from this needed investment, public works and urban

renewal should become partners wherever possible in the revitalization of the city.

East Orange has seen the opportunity available through urban renewal to make a significant contribution toward new housing for its citizens, a revitalization of its economy and the implementation of a public works program. They are but one of the communities all over the country utilizing the urban renewal program in this way. Large and small communities alike, which meet the eligibility requirements and have a purposeful re-use for the project site, have found urban renewal a workable and efficient program.

Radio Aids in Tornado Cleanup

THE TORNADO that struck Chicago's south side March 4 left a gigantic cleanup task for the City's various departments. The disaster emergency demanded the immediate attention of all departments in the city—The Police Department, Fire Department, Department of Public Works' Bureau of Forestry, Department of Water and Sewers, Department of Streets and Sanitation.

At the start, trucks, crews and supervisors from all departments converged on the area, ready to go to work. Just having all this manpower and equipment wasn't enough for efficient cleanup, however—centralized coordination was needed. The coordination was provided by mobile two-way radio.

Chicago's Mayor Richard J. Daley, took charge of the entire cleanup program, working from a radio unit. The Bureau of Forestry moved 40 Motorola radio-equipped vehicles into the tornado-stricken area, in-

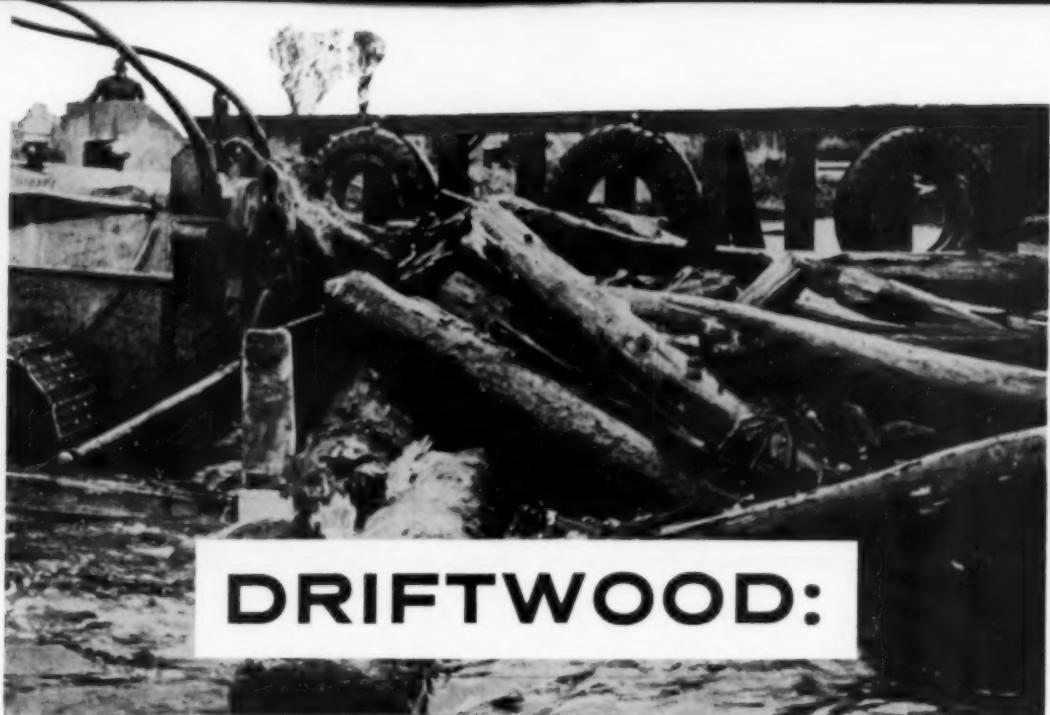
cluding 10 of its mobile towers with 45-foot aerial ladders to clear away branches from roofs and power lines. Three supervisors with radios in their cars were assigned specific territories. It was their job to coordinate the efforts of the crews working within their territories.

Radio-equipped crew trucks made up the rest of the 40 Forestry units. From a city car equipped with a radio, Forestry's Daniel Coman coordinated the Bureau's total effort by serving as radio dispatcher. All calls came to him and he relayed them to supervisors, crew trucks or mobile towers in the best position to provide the fastest followup.

The overall result was that trucks, men and equipment were being sent from job to job within a tight area, cutting wasted travel and time. Backtracking was eliminated since one crew could be dispatched to handle several jobs in the same neighborhood.



● TORNADO in Chicago's south side last spring left a cleanup job of major size.



DRIFTWOOD:

● BULLDOZER cleans driftwood from drainage channel and pushes it to one side for disposal by burning.

A DRAINAGE MAINTENANCE PROBLEM

JOE CREISLER

Flood Control Coordinator,

Del Norte County Flood Control District,
Crescent City, California

OF ALL the sea-borne driftage, none is so beautiful and so sought after by the beachcomber, tourist and artistically inclined as driftwood. Nevertheless under some circumstances driftwood can endanger the public health and safety by blocking drainage channels. This is one of the troublesome drainage problems faced by the responsible agencies of Del Norte County, particularly the Flood Control District, since the natural drainage outlets to the ocean become blocked and choked up by driftwood brought in by storms and high tides and must be cleared to prevent flood damage.

Natural drainage outlets which carry heavy runoff into the Pacific Ocean are located in the fringe areas of urban Crescent City. The surplus waters from the uplands and surrounding urban areas first pass into swamp and marsh lands, cross U. S. Highway 101 through culverts, then drain into the channels which empty into the ocean. Driftwood and other material which comes in with storms and winter high tides accumulates at these

points of discharge on the Crescent City beaches.

The driftwood is forced into the narrow mouths of the drainage channels by wave, wind and tidal action. As this proceeds, the waves build up a sand bar which combines with the many different sizes of driftwood to dam the channel. The blockage soon results in flooding of the highway, the surrounding low swamps and urban areas. Since individual sewage disposal systems are used for waste disposal in the urban fringe areas, flooding causes a serious sanitation problem. At times runoff from rain storms may breach the driftwood-sand bar dams, but in most instances flooding occurs.

The problem has its beginning with the trees and brush which are windfalls, victims of disease, after-maths of logging operations, and other sylvan debris which fall or are left in or near creeks, streams and rivers of the extensive Klamath River watershed. This forest debris, including large logs, is picked up during periods of heavy rainfall and eventually is carried down the Klamath River into the Pacific Ocean some twenty miles south of Crescent City. The driftwood is then carried north by local coastal currents and deposited all along the coast by wind, wave and tidal action.

During the December, 1955, flood on the Klamath River, thousands of boardfeet of logs from logging operations throughout the lower Klamath River Basin were picked up by the flood waters and deposited on the Del Norte Coast beaches. Regular logging operations were carried out on these beaches with the problems of ownership, salvage and removal being supervised by the Sheriff's Office. Some of the accumulated driftwood on the beaches today come from the flood disaster of 1955.

Maintenance of natural and artificial drainage outlets into the ocean, with the complicating factors of off-shore currents, waves, winds and tides, is a herculean task in itself without contending with the frustrating driftwood. No matter what is done, the problem is never really solved. If all the driftwood in the mouth of a channel is removed, it exposes the banks and surrounding shoreline to direct wave action which results in erosion. To prevent erosion some large pieces of driftwood may be kept within the channel to serve as a cushion. Unfortunately, the cushion catches incoming driftwood so that the channel is soon blocked again. In other cases, the channel mouths have been cleared of all driftwood only to be choked up again by the next storm.



● AFTER the storm. This shows how debris piles up at the narrow mouths of the drainage channels due to wind and waves.



● DRAINAGE channel after debris has been removed by bulldozing. Here some is shown piled at right; burning is usual.

In order to reduce the cost of removing driftwood from the natural channels, especially when the driftwood is forced far up into the outlet, the District has installed drift barriers at two of the more important channels. These barriers were built as close to the shoreline as possible, allowing for a tie-in to stronger soil formations for the purpose of holding the barriers and preventing them from being directly exposed to wave action. During the storms of 1958 one of the drift barriers which directly faces the open sea was completely lost. It was rebuilt, but lost again in the February storm of 1960. This barrier at Station B-631-15 has been replaced again by construction of a steel drift barrier. The other main drift barrier, located near the south Crescent City Harbor jetty and constructed of wooden piling with log fingers, was weakened in both storms but was repairable. Financing installation of the drift barriers was a joint venture with the State Flood Relief Act, State Division of Highways, and the Flood Control District.

One of the problems the District has had in its drainage maintenance work has been the question of what to do with the driftwood. In the past, the driftage was bulldozed to each side in order to relieve or prevent damming. This had little lasting effect since the next high tides and heavy waves moved the driftwood right back into the mouth of the channels along with added storm debris. It is now the practice to burn the driftwood right in the channel during periods of good weather to reduce the amount of debris. When the channels are opened and cleared by heavy equipment, the pushed-out debris is also burned. This leaves much less driftwood to fight the next time.

In early fall before the winter storms the District undertakes initial clearing and removal of accumulated driftwood and sand bars built up to a minor degree during the summer months. This work is carried out by force account with a private operator who uses a D-6 bulldozer. Because of the large size of some logs, additional personnel are used to serve as choker-setters in pulling individual logs from the debris pile.

Removal Methods

Starting from the outer edges of the pile inward, the driftage is pushed, hauled and piled to one side of the channel. Care is taken not to disturb the channel banks. As the pile is started it is set afire and additional driftwood debris is constantly pushed into the blaze. When burning driftwood it is most important that equipment be available to keep pushing and bunching up the fire since the material burns only by radiant heat and if left to burn by itself the fire would soon die out.

Timing of the removal work is essential in order to take advantage of the changes in the tide and get the job completed during the ebb-tide period. The pile of pushed driftwood debris is so located as to minimize the effects of high tides which might move portions of the piled material or put out the fire. The time, personnel and equipment used in carrying out the clearing and removal of driftwood debris from the channels depend upon the amount of accumulated material and can run from two to six hours of equipment time, with one to three men serving as chokersetters.

This burning procedure is not without its problems since the District is despoiling a recreational

area with ashes and charred wood, causing a smoke nuisance which drifts across a main highway and is taking the calculated risk of setting fire to the tons of driftwood on the beach.

After the channels are cleared, they are patrolled and command decision procedures are used as to when they should be opened and cleared again. At all times the District must try to anticipate the weather and the resulting severity of the storms since limited monies are allowed for the work and the District cannot afford to keep the channels open continually.

At times the District has guessed right, opening and clearing the channels just before a heavy storm and preventing flood damage. At other times the District waited too long so that flooding occurred. At the first break in the weather, the channels are reopened.

The Del Norte County Flood Control District undertakes the drainage maintenance of the natural outlets as a joint venture with the California State Division of Highways. Expenditures are shared on a 50-50 basis. The District is responsible for off-road drainage and the Division of Highways is responsible for road-side drainage. The District is reimbursed for half the amount spent for maintenance by the Division of Highways upon billing by the Flood Control District.

In assuming the responsibility for the maintenance of the natural drainage outlets to the ocean, the Flood Control District has undertaken a never-ending task of attempting to out-guess the action of the weather on sea-borne driftwood and debris. This activity demonstrates again that there are many facets to be considered in a public works endeavor.



Soils Know-How for Cities

BERNHARD A. ROTH
Soil Conservation Service,
U. S. Department of Agriculture,
Upper Darby, Pennsylvania

PLANNERS of fast growing urban communities in Connecticut have turned to farm scientists for help. A newly found common interest in soil and its potentials has created a unique partnership between city men and farmers at Hartford, Danbury, Stamford and half a dozen other localities. Professional planning consultants believe that the exchange of soil knowledge now going on between dairymen and crop growers on the one hand, and urban officials on the other, may revolutionize methods of community planning and zoning.

Maps of soil on farms, it was discovered, reveal considerably more than where to place cornfields and pastures. Interpreted by U. S. Soil Conservation Service experts, the maps also show the severity of slope and erosion, wet and dry areas, flood hazards and seepage problems—as well as the best soils for crop cultivation.

Following a session on soils information with farmers of the Fairfield County Soil Conservation District, Danbury's town planners requested a special soils map of their 42-square mile area. Farmers and their assisting SCS technicians responded with what they termed an "abbreviated" map of local land resources.

Overlaid on standard topographical sheets, it gave a full-length portrait of soil and water conditions.

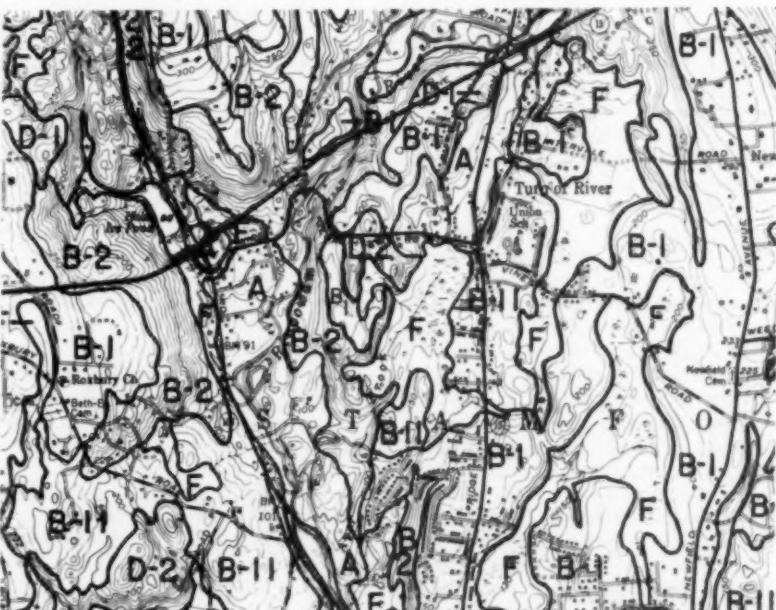
Using it as a base reference, Danbury's professional planners designed a master layout to allocate housing, industry, schools, shopping centers and roadways for 30,000 additional residents expected in the coming years.

Third-dimensional information furnished by the soil survey gave planners an outstanding advantage. No longer was it necessary to guess at what construction men might face. Eleven different land resource classifications outlined by the map showed underground phenomena in addition to surface features. For example, a tracing of upland soils

indicated that water infiltration rates would likely be too slow to handle septic tank effluents; and that road construction and maintenance would be costly.

Poor sites for houses and industry were indicated clearly in soils mapped along streams and rivers. There, surveyors pointed out, developers would face double trouble in the form of difficult drainage and frequent flooding.

Planners looked closely at the map's delineation of terrace soils. Here, surveyors had underlined a potential for nearly all types of agriculture. Likewise they had noted



● SAMPLE land resource unit map showing soil inventory made at Stamford. Area is 9 1/2 sq. mi. Soils are coded alphabetically and numerically on standard USGS sheet.



● CENTER of Ridgefield, Conn. Land resources unit map is used extensively here to guide development of community. LRU survey shows many soil and water conditions.

the eminent suitability of the soil for high density, urban development—good drainage, freedom from floods and easy excavation.

Danbury and towns that have followed suit in requesting resource maps over the past year have received, in essence, a rating of all local soils according to such limitations as drainage, suitability for septic tank functioning, flooding hazard, depth to bedrock, stoniness and excessive slope.

Communities have drawn upon the maps heavily to substitute orderly progress for chaotic urban sprawl. Decisions as to type of development, as well as location, have been supported by the natural resource data. Rulings as to size of house lots have been less subject to criticism when bolstered by scientific soil findings. Real estate men have been guided to money-saving land treatments prior to building. Inexpensive and previously unknown sources of road-fill and landscaping materials have come to light by means of the maps.

Prejudicial arguments as to the merits of one type of zoning over another have been brought to a halt when confronted by the solid facts of soil and water presented by the survey.

To the delight of Connecticut's far-seeing planners—many of whom place an ever-increasing premium upon open space—the soil map method has offered a hedge against the endless monotony of subdivision. For instance, Stamford used

its resource guide to allocate a 30-acre swampy area as a wildlife preserve. Similarly, Danbury, flood-ridden in recent years, has dedicated streambank areas to the interests of nature-lovers. The same areas will serve to protect sites for future flood-control structures.

A few of the resource-guided towns are planning to purchase outright or buy easements aimed at reserving their richest farmlands.

Use of the resource maps to locate and conserve future water developments is a noticeable trend in all communities involved in the current movement.

Community resource maps are an outgrowth of a half-century-long effort by the U. S. Department of Agriculture to evaluate all 2 billion acres of the nation. The survey—about one-third complete—is in charge of the Federal Soil Conservation Service cooperating with state agricultural experiment stations. It results from field-by-field examinations conducted by trained soil scientists, sampling with augers and spades. Physical and chemical tests in soils laboratories help refine interpretations.

Printed copies of finished surveys usually cover a county at a time. Limited numbers of the reports are usually available at farm agency headquarters, land-grant colleges and county government offices.

SCS field surveyors are located near to most of the nation's 3000 locally-administered soil conservation districts. Prime demand for soils information continues to come from 2 million district cooperators who use the data to plan drainage, irrigation and other measures for food and fiber production.

Meanwhile, as farmers and ranchers diminish in numbers across the land, they are apparently passing along a rich heritage of soils know-how that may result in a more happily planned suburbia.

Open-Top Reservoirs Provide For Future Domes

Two new prestressed-concrete reservoirs serving the City of Port Angeles, Washington, are located remote from air borne wastes of city and industry. Hence, they are not covered, with a resulting savings in the overall cost.

With an eye toward possible future encroachments by nearby urban districts, however, tank walls were built so they would support domes, should it ever become desirable to cover the tanks. Port Angeles learned this lesson from several north-central towns which built open-top tanks in rustic areas, only to be faced with serious enclosure problems some years later due to engulfment of the facilities by growing towns and cities.

One of the Port Angeles tanks holds two million gallons, the other seven million. The small tank is 110-ft. in inside diameter by 30-ft. high. The large one is 187-ft. in inside diameter by 36-ft. high. Both

tanks were constructed largely below grade. The small tank wall is 8-in. thick, the large one 15-in. Both walls are of prestressed concrete and were wrapped with high tensile prestressing wires. The large tank has four layers at the base, two at the mid-section and one at the top. In all, some 200 miles of wire were wrapped.

The tanks are in an earthquake zone, and a cable network has been provided between the footings and walls to prevent earthquake damage. The cable network comprises a series of endless cables embedded partially in the footing and partially in the wall to restrict any appreciable shifting of the wall.

Engineers for the project were R. W. Beck and Associates, Seattle, Wash., and Columbia, Neb. Del Guzzi Construction, Inc., Port Angeles, Washington were the contractors. Prestressing was by the Preload Co., Inc., New York, N. Y.



Photos courtesy Caterpillar Tractor Co.

• LANDFILL is being built in cooperation with county flood control agency as a levee; it will be riprapped later on.

County Runs Economical Landfills

Annual refuse disposal cost in San Bernardino County, California, the largest county in the United States, averages 72¢ per capita.

J. R. HILLER
Rubbish Disposal Superintendent,
San Bernardino County, Calif.

THE LARGEST county in the U. S., covering 20,131 square miles, disposes of rubbish for its half-million residents at a cost of less than 72¢ per person per year. San Bernardino county operates its entire refuse disposal program on 0.77 cent of the tax dollar. This includes maintaining four large cut-and-cover sites with a volume of more than 4,700 tons a week as well as 28 open burning dumps, which we eventually hope to convert to landfill. The annual per capita cost is based on an operating budget for 1960-61 of \$358,041, excluding land cost, and a 1960 population count of 503,591. Purchase of land is considered a capital asset.

The four landfill sites, located in the heavily-populated valley area, are maintained by three current Caterpillar D8H and two older D7 tractors, while the 28 open dumps in the desert and mountain regions are cared for by two D4s. Another D7 is currently preparing an extension to an existing landfill.

Helping keep disposal costs down have been such factors as consolidating county-city efforts, placing the disposal program under the County Highway Department, lo-

cating landfill sites to assure sufficient volume and using reliable, heavy-duty tractors to handle large volumes efficiently.

Cooperation between county and cities in pickup and disposal has, we believe, produced a better overall program at more economical cost. For example, in recent years volume has increased markedly. At one site, Plunge Creek, volume jumped 100 percent in a year's time, due to population growth, enforcement of air pollution and fire regulations preventing the burning of rubbish, and the closure of city and private burning dumps in that area. At the smaller Milliken Avenue site, volume doubled in six months for much the same reasons. Had a single small town been confronted by this sudden increase, it would have been in serious difficulty, but because we are set up to handle large volumes, we have been able to take it in stride. On the other hand, the county does not pick up rubbish; this is handled by the individual cities and private contractors.

The county's rubbish disposal program has been under the direction of the County Highway Department since 1956, with day-to-day operations handled by the Rubbish Disposal Superintendent. Thus we are not only able to draw upon the department's equipment pool as the

need arises, but can take advantage of its maintenance and service facilities.

The county attempts to place its sanitary landfill sites so that hauling distances are as equidistant as possible from the various participating cities. One D8 tractor, we have found, can serve approximately 75,000 residents efficiently and economically. Some areas are not as fully populated yet, but it is necessary to operate a site because of hauling distances. In such cases the work load is less than ideal, with the result that disposal cost per ton increases. Table 1 gives average data on the four cut-and-cover sites operated by the county.

The county's total 1960-61 budget for rubbish disposal is \$458,041 which includes \$100,000 for land purchase, \$48,515 for equipment purchase and \$309,526 for operations and overhead.

However, in computing operating costs, land cost is not included because we feel that the value of the land does not depreciate. If the recommended use of landfill sites is carried out, such as parks and industrial sites, the land value still exists (often it rises) and therefore is considered a capital asset and not a cost.

The disposal program is financed through general property taxes



● LANDFILL is compacted with 24-ton tractor with a cover of 18 to 24 inches of rocky material. Surface is built up to 22 ft. above grade for possible industrial use.



● PROTECTION for operators on tractors is provided by special fiberglass Jamieson whitecap helmets which circulate filtered air and which are equipped with faceplates of shatterproof glass.

city since last spring, along with Patton, Highlands, East Highlands, and Loma Linda. Working in co-operation with the county flood control district, refuse is being utilized to construct a 1,400-foot levee as protection against the Santa Ana River and Plunge Creek just south of the levee.

Approximately 250 feet wide at the base, the levee reaches a total height of 35 feet, including 10 feet below grade. Excavated material as well as that found elsewhere on the site is used as cover. Refuse is dumped at the base and dozed up a 4:1 slope. Here as well as at the other landfill sites, the tractors take a small amount of dirt on the blade along with the refuse to reduce scattering of papers by the strong winds and to aid in compaction. The dike is covered nightly with a 6 to 8-inch layer of sandy clay and rock. Final cover ranges from 12 to 18 inches, after which the U. S. Army Corps of Engineers will cap it with

rather than by charging for each load dumped. For us this is the simplest system of financing; also since everyone produces rubbish and benefits from its disposal, every property owner should share the cost.

Landfill-Levee Project

Plunge Creek, biggest of the landfills, is located in San Bernardino and has been serving most of that

concrete and riprap. The double-purpose landfill-levee project is working so well that plans are already underway for a 5 to 6-mile levee on the south bank of the Santa Ana River from Redlands to Colton.

The Cat D8H tractors at the Milliken and Highland Avenue landfills are working in blow sand and rocky material respectively. Cutting and filling, both are gradually raising the level of terrain by successive layers of compacted refuse. The 31-acre Milliken site serves Chino, Ontario, Mount Clare and Alta Loma. When completed, it may become an industrial site. The 60-acre Highland landfill, handling rubbish from Fontana, parts of San Bernardino and Rialto and all of Muscoy, is expected to be used eventually as a recreational area.

Crestmore, the fourth and smallest landfill, is located in an abandoned rock quarry. Approximately 150 feet deep, it will level out to a 20-acre park site about five years hence. In this operation, the D7 is covering rubbish with sandy overburden stripped from the quarry and stockpiled adjacent to it.

Tending 28 burning open dumps in a county the size of San Bernardino is no easy task. The two D4 operators transport their tractors in 1½-ton trucks with tilt-down trailers, sometimes traveling as many as 219 miles to reach the site. Each D4 operator spends a day at a dump, stockpiling refuse, cleaning up the site and maintaining access roads. At mountain sites, 1,000-gallon water tanks have been established for emergency fire protection.

• • •

Kit Helps Analyze Mowing Jobs

A personalized free service for institutional users of grasscutting equipment has been developed by Toro Manufacturing Corporation, of Minneapolis. Based on the techniques instituted by the insurance field, Toro representatives will make detailed custom surveys of the grass-cutting problems of golf courses, park and highway departments, schools, cemeteries, resorts and other institutions; evaluate equipment requirements; and prepare written proposals covering present mowing tasks, equipment, operation costs and an analysis of possible seasonal savings.

Survey and proposal forms as well as miniature slide-rules for on-the-spot grass cutting calculations are included in the "Toro Planned Service for Grass-Cutting Machinery" kit.

Table 1—Operating Data, San Bernardino County Refuse Disposal

Site	Population	Weekly Tonnage	Cost per ton	Tractor Model	Acres Filled Per Year
Plunge Creek	150,000	1,964	.80	D8,D7	11.3
Milliken Ave.	75,000	1,116	.77	D8	4.0
Highland Ave.	70,000	1,026	.63	D8	3.7
Crestmore	45,000	636	.86	D7	2.6

GLASSWARE BREAKAGE— A Major Lighting Maintenance Problem

ALBERT H. RULING

Specialist-Product Service,
Outdoor Lighting Department,
General Electric Company

G LASSWARE breakage has been the major problem of the electric street lighting industry since it was introduced some 80 years ago. For years glassware replacement has been a major cost item in the maintenance of a street lighting system. The introduction of pressed glassware reduced the breakage rate to some degree due to its greater mechanical strength. In 1936, General Electric contributed spun-on glassware, which reduced the breakage rate still further. While these innovations have greatly reduced the rate of breakage, the cost of replacement glassware is still formidable.

Recent studies indicate that the causes of glassware breakage fall into three primary classifications: Thermal shock, vandalism, and accidents. Thermal shock is by far the greatest single cause. It is caused by the temperature differential between the inside and outside surfaces of a glass refractor exceeding certain limits. It is fairly obvious that the inside surface of the piece of glassware, which is closer to the lamp, will be hotter than the outside. This means that the inside will expand at a greater rate than the outside, putting the outside surface under tension. When the tensile strength of the glass is exceeded, the glass will break.

Mechanical stresses introduced by overtight globeholders add to the thermally introduced stresses and make the glassware subject to breakage at lower temperatures. Chips, nicks, and bruises in the outside surface and uneven light distribution can cause stress concentrations which substantially reduce the heat resistant characteristics of the glassware.

Glassware breakage from vandalism was once thought to be the largest cause, but examination of maintenance records of operating companies reveals breakage due to vandalism is a sporadic sort of thing confined to certain localities and

times of the year. For example, vandalism is particularly bad at Halloween and after Christmas when children are trying out their new air rifles. The so-called "lovers lane" areas are equally subject to a high vandalism breakage rate.

Breakage due to accidents accounts for a relatively small percentage of the total breakage. Breakage of this nature is caused by such things as windstorms, falling tree limbs and cars running into poles.

Many factors contribute to thermal-shock breakage, but in general,

this can be broken down into two classifications—controllable and uncontrollable. Controllable factors can be further broken down into two groups—those controllable by the manufacturer and those controllable by the street-lighting-system operator. One of the items controllable by the manufacturer would be the design of the luminaire in general; that is, making it large enough so that it can dissipate the heat generated by the light source and, if necessary, putting in auxiliary heat dissipation devices. The manufacturer can select a glass composition



● MEMBER of maintenance crew unlatches refractor lens during a periodic check and cleaning of glassware as a part of a regular street lighting maintenance program.

which is less subject to thermal-shock breakage; for example, the so-called heat resistant or borosilicate glass is less subject to breakage than soda-lime glass. Four years ago, General Electric introduced plastic refractors which eliminate the breakage problem almost completely for luminaires rated 250 watts or less. Extensive research is under way to develop plastics suitable for use with higher wattages.

Globe holders should be designed to eliminate mechanical stresses. The physical shape of clamped refractors should be circular rather than square for better stress distribution. Reflectors must be designed so that there are no hot spots and light rays are not sent through the lamp, increasing its heating capacity. This brings us to the factors which are controllable by the operator.

In general, operators can avoid excessive glassware breakage by operating the luminaires as the manufacturer intended; that is, no use of lamps of a higher rating than that for which the luminaire was designed. The operator should watch his voltage and current so that his lamps are not drawing excessive wattage, therefore generating more heat than would normally be expected from a lamp. The operator also must handle refractors carefully, realizing that any chip or bruise on the outside surface can only lead to broken glassware. The easiest and simplest way to cut down on glassware breakage is simply to wash the refractors periodically. Dirty glass traps heat and makes the glassware more vulnerable to thermal-shock breakage.

The primary uncontrollable factor is weather. Fast moving cold fronts, sudden driving rains, sleet, hail or snow can be disastrous to hot glassware.

What is being done to attempt to reduce this waste of money? There are several avenues of approach. In the design area, the refractor material, as mentioned before, can be made of plastics, or a more heat-resistant glass than is presently being used. The refractors can be mounted to allow for expansion and contraction with temperature changes. Refractors and luminaires in general can be large enough to dissipate heat adequately. Better sealing designs to prevent dirt from entering luminaires can be developed. All of these and more ideas are being worked on.

In the operational field, better maintenance can reduce waste. Bearing in mind that the purpose of modern luminaires is to give the most light for the least cost, up-to-date maintenance techniques will insure that the operator can protect his investment and increase his profits by giving more lumens to the street-lighting customer—that is, the public. Group replacement of incandescent lamps will reduce outages. Periodic washings will keep the glass clean and reduce the breakage. Checks of voltage and current will keep the lamps operating at their rated values.

Although glassware breakage is a serious problem, it is not an insurmountable one. Adequately designed luminaires, properly installed and properly maintained, can give satisfactory service with a minimum of glassware breakage.

S-T-R-E-T-C-H



JAMES MILLER

Chairman, Board of Supervisors,
and Road Master,
Independence Township,
Beaver County, Pennsylvania

THERE IS NO blueprint for a perfect program in township road management. Independence Township, however, has developed plans for solving some of our road problems while keeping a sharp eye on costs. The Township has about 1200 inhabitants. That number grows annually, which is one good reason why we have to keep our roads in good shape. At least 11 of our 33 miles of township roads are well used.

In addition to the writer, the road maintenance and improvement is in the hands of George Brunton, secretary of the township, and supervisor Clyde McElhaney. We work as a team in supervising all road improvement operations, hiring part-time laborers, and building a mile or so of new road every year. Our money comes from several sources. Property taxes bring in, usually, less than \$7,000 per year; state money for roads runs a little over \$10,000, and varies yearly; we get around \$3,000 from a per capita tax, and recently put a wage tax of 4 mils into effect, which should bring in about \$5,000.

This gives us approximately \$25,000 per year with which to work. To spend it wisely, we study comparative costs. For instance, we re-



● **VANDALISM** can be an important factor in light damage, but bullet hole in this new plastic lens demonstrates shatter resistance of the acrylic plastic refractor. Operation of luminaires as manufacturer intended, will also reduce glass breakage.

the Road Dollar in Township Work



● INTERSECTION shows results of road widening and surface improvement.



● TOWNSHIP secretary George Brunton checks blade on the Township's new motor grader. Stabilized surfaces need less maintenance, saving labor and blade costs.

cently purchased a good quality road grader that cost approximately \$17,000. We had been paying from \$12 to \$14 per hour for hired grading and, at that rate, we figure the new grader will pay for itself in about two years. We use it in blading, building new roads, winter snow removal and general road work.

Currently, we have a road improvement program underway to bring our narrow, pitted unstable roads up to 20-ft. wide, sound, smooth surfaces. Base building and stabilizing with slag is topped off with a calcium chloride treatment that controls dust, retains the fines, and looks ahead to the day of paving with a good bituminous surface.

In preparing a new base, the old roadway is roughed out with a rental bulldozer; then our grader shapes it. We add No. 2 or No. 2B slag as needed. Slag costs about \$2.85 per ton delivered and we've been using some 3,000 tons yearly in our road improvement. To reduce the need for hauling and slag replacement, we have been using calcium chloride, applied in several ways, with considerable success. We put on about 18 tons in 1960. A truck, used for spreading agricultural lime, hauled about 7 tons from the supplier. That wasn't a good operation for the trucker, so we bought the last 11 tons bagged. With three men working, we used a small lime spreader and dump truck, and put it all down in about 15 hours.

The work was mostly spot treatment where greatest traffic prevailed in front of homes and schools. The treatment pattern was about nine feet in width. We could see early this spring how successful this treatment was. The road took the winter without heavy loss of slag or need for excessive bladings. We put about 11 replacement cutting edges on our grader blade annually. These cost about \$22 each. With treatment of roads, we expect to save bladings and hence blade edge replacement.

After our experience with dry calcium chloride, we decided to try the liquid form this year. Four tank truck loads, at about 2,000 gallons per load, were used to cover about two miles of road (spot treatment mostly) in patterns 9 and 12-ft. wide. The 9-ft. application is expected to spread gradually to 10 ft. or better, through traffic use and runoff.

We went to liquid for a trial this year for several reasons—easy handling; improved effectiveness; speed and uniformity of application; and no storage of bagged or bulk material with the attendant extra handling, labor and expense. We still consider the use of bulk calcium chloride as a good procedure and may consider purchase of a truck and spreading unit at a later date.

We paid about 12.5 cents per gallon for the liquid calcium chloride, totaling about \$1,000 for the 8000 gallons used. The operation was performed by Keystone Salt Serv-



● APPLICATION of liquid calcium chloride for road stabilization and dust control. One truck load (about 2000 gallons of 34 percent material) treats a half-mile strip of a road like this.

ice, Inc. of New Bethlehem, Pennsylvania. The solution (bulk calcium chloride added to about 1700 gallons of water in the tank, at railroad siding) was tested thoroughly, with supervision by township men, to assure the 34 percent concentration required to do the proper job.

In the last seven years, we've improved about 22 miles of township road. We think it's just the beginning.



● BEFORE: This photograph shows how Burts Bay, an arm of the lake, looked back in 1953 before chemical control work.



● AFTER: Burts Bay in August, 1960. View from the same place as picture at left, shows result of anti-weed program.

FIGHTING LAKE WEEDS WITH CHEMICAL SPRAY

ROBERT DYMENT

Technical Writer and Reporter

NUISANCE WEEDS, so thick that it was impossible to boat, swim or fish, posed a problem at Chautauqua Lake, N. Y. The lake is a major industry of the area, famous for muskie and bass fishing and as a resort area, and attracting an estimated six million tourist dollars annually to the region.

To protect this asset, the Chautauqua Lake Association, Inc., was formed. To initiate the weed control work, New York State operated a pilot control program in 1956, 1957 and 1958, spraying 136 acres. The work has since been carried on by the Association which in 1959 treated 780 acres of the lake and 720 acres in 1960. The State grants a permit for the work, limiting the spraying to 200 ft. from the shore; or further if the water is less than 6 ft. deep. Association funds come from subscriptions by local business and industry, but the County appropriates \$1 for each \$4 raised by the Association. The treatment is not permanent—some areas have to be treated every other year, but each year the job becomes less difficult. The cost in 1959 was \$18,000, and \$20,000 was budgeted for 1960.

Sodium arsenite is the chemical principally used, but at the request of the State, 2-4-D was used in some areas. A 30-ft. aluminum

barge, modified to carry the spray equipment and chemical drums, was originally an Army pontoon. It can carry 13 drums of chemical and delivers up to 60 gallons per minute of the solution.

The process involves spraying the sodium arsenite solution on the lake's surface in the ratio of 7½ parts of sodium arsenite to the million of water. The poison descends through the water to the weeds and kills or reduces their growth. All areas sprayed or to be sprayed are posted by the Association with warnings that chemical weed control is in progress. Persons in the areas are advised to stay away from the equipment, to keep their animals away and not to use the water for any purpose until it has been cleared by the Jamestown office of the State Health Department. This clearance usually comes in about 10 days, following systematic tests of the water.

Preparation for the spraying program is carried out during the winter under somewhat sub-polar conditions, when members of the Association, aided by many volunteers, bore holes in the ice to measure the water depths in the areas the CLA has mapped for weed spraying. Called for is a lot of ingenuity and hard work, made necessary by a State requirement that soundings and computations of water volume must accompany maps the Association has prepared of the

weeded areas to be sprayed. Sonar sounding equipment cannot be used through the ice but reliable data from an earlier hydrographic-survey is used to help compute the depths. These are carefully checked by the State before a permit to begin spraying is granted.

Ferdinand Wiener, State District Health Engineer, works closely with the Association on the through-the-ice soundings. This work has to be done during cold weather since application for a permit must be sent to the State Water Pollution Control Board well in advance of planned operations.

The Control Board limits the maximum concentration of arsenic trioxide, the effective weed-killing agent, to 10 parts per million. In order to determine the total amount of spray materials necessary in any given area, it is necessary to determine the volume of water in that area. This entails finding the depth of water as well as computing the surface area.

Efforts were made to secure hydrographic maps showing the water depths in the marked areas but it was found that no up-to-date maps were available. Then it was decided to go through the ice with graduated sounding chains weighted with lead. Thickness of the ice is usually 18 to 20 inches.

The pattern of boring is laid out by maps prepared by a weed control committee. Working from these

maps, holes are bored in a grid pattern at intervals of 200 feet, covering areas from shore averaging from 300 to 500 feet, but in some cases going out as far as 800 and 900 feet. In computing water volume, changing lake levels also have to be worked into the calculations.

The first locally financed weed killing project got under way in June, 1953. With a three-man crew and four sanitary inspectors aboard as observers, the barge started distributing the sodium arsenite solution over lake waters. Differing from the method used by the State, the spraying is done from the barge through a 20-foot boom which carries 14 quarter-inch nozzles held close to the water surface.

Results of the spray program are illustrated by Burtis Bay. Only a few years ago it was popular to put on a wry expression and remark bitterly that with snow shoes, you could walk across the weed beds. Today there are no weed beds. The same is true in most of the formerly weed infested areas of Chautauqua Lake. Association officials declared the results of 1959 spraying "amazing." The weed control chairman said: "I have heard nothing but the most enthusiastic reports from all sections of the lake. The weed kill in 1959 was successful beyond our wildest hopes. Of course, there are always floating weeds, but even those were down to a minimum."

The sodium arsenite for the 1960 program by the Association was supplied by Niagara Chemical Division of Food Machinery and Chemical Corporation, Middleport, N. Y. The shipment consisted of 109 steel drums, each containing 55 gallons of the chemical. The cost was 68 cents a gallon for a total of \$4,076.60.

The spray program for 1960 began on May 31 and was scheduled so as not to interfere with use of the lake during the Memorial Day weekend and to come well in advance of the regular vacation season. It was completed June 8. A large dredging barge was used to supply material to the weed spraying barge as needed. Dropped from the 1960 program was Burtis Bay which has been treated successfully for four consecutive years. Results there will be watched closely by weed committee members.

The 1960 weed control program on Chautauqua Lake has been termed a success, even though the weed kill in some spots was not as good as 1959—attributed to unfavorable weather conditions. Best results were reported in the extreme

lower lake, where the weed beds have been most annoying.

Last year, 1960, was only the second year that the Association has conducted the weed control program. Officials said they are still experimenting and since weed spraying itself is a relatively new

concept, time is needed to improve operations. This year, 1961, will be the third year for the program and each passing year will see less and less weed growth on Chautauqua Lake, thanks to an energetic group of interested persons in Chautauqua County, N. Y.



● DEPTH of water is measured to determine total amount of chemical needed for weed control. Holes are bored through ice and graduated sounding chains are used.



● SPRAYING barge of aluminum was assembled locally. It can carry 13 drums of arsenite and delivers 60 gpm of solution from 20-ft. boom having 14 1/4-inch holes.

Irrigation as a Sewage Re-Use

W. N. WELLS
Sewage Treatment Plant
Superintendent,
San Antonio, Texas

IN SEMI-ARID regions, the re-use of sewage treatment plant effluent by irrigation has been practiced for many years, and with certain limitations affords many advantages over disposal into waterways. The municipality gains by not having to provide quite the high degree of treatment as would otherwise be necessary; the farmer gains by acquiring a dependable source of water for irrigation, the plant nutrients present in all sewage plant effluents providing a small added bonus; and the nation gains because disposal by irrigation, if properly practiced, eliminates all possibility of stream pollution.

San Antonio, Texas is situated in a region which experiences cycles of drought and limited rainfall. It was natural then, that apparently the first method of sewage disposal practiced by the city was the conveyance of sewage to the south in closed sewers where it entered open ditches for irrigating several square miles of farm and ranch land. In 1901, the city passed an ordinance to execute a contract for the construction of a ditch and a dam on Mitchell Lake for the proper disposal of the sewage of the City of San Antonio. Prior to that time, the city had operated a sewer farm in that vicinity valued at \$28,000.

By 1925, the volume of sewage had increased to such an extent that during periods of rainy weather, it was difficult to dispose of all sewage by irrigation without creating a nuisance. In October, 1930, a modern sewage treatment plant was put into operation with a flow-through capacity of 25 mgd. This plant, with additions, served the city until January, 1951, when another treatment unit was put into operation which more than doubled the plant capacity. Improvements have continued since that date to bring the total plant capacity of the combined units to 82 mgd in 1961.

During the years, irrigation practices in San Antonio have changed somewhat. The irrigation of vegetables, melons and berries and all irrigation north of the sewage treat-

ment plant was prohibited by injunction. Irrigation of pasture lands and non-vegetable crops has continued and has been increased in the area south of the plant and around Mitchell Lake. The operation of the plant has of necessity been closely correlated with irrigation practices. As with most municipal plants, the San Antonio plant has experienced long periods of overload due to lack of funds for necessary enlargements. The presence of Mitchell Lake and the practice of irrigation have enabled the plant to operate through these periods of overload with a minimum of complaints.

Composition of Irrigation Water

It is possible to discharge clear secondary treated sewage either to the San Antonio River or to the canal. Any effluent which enters the river must be of top quality and must be chlorinated. During heavy rains, partially treated and untreated sewage is bypassed to Mitchell Lake. During normal operation of the plant, the canal to Mitchell Lake receives:

1) Final effluent, a clear, biologically stable water containing about 10 to 20 mg/L suspended solids, one to four mg/L nitrate nitrogen, six to eight mg/L ammonia nitrogen

and about 150 mg/L chlorides as sodium chloride. Final effluent is 85 to 90 percent of the total amount of water discharged to the canal.

2) Primary treated sewage, from which most of the suspended solids have been removed by primary sedimentation. This contains about 18 mg/L ammonia nitrogen and makes up 6 to 10 percent of the discharge.

3) Digester supernatant liquor, a very strong liquid containing 2000 to 5000 mg/L suspended solids and about 400 mg/L ammonia nitrogen. It constitutes from 2 to 5 percent of the flow to the lake.

4) Excess activated sludge, a brown flocculent sludge consisting of 6000 to 8000 mg/L suspended solids, about 6 percent nitrogen (on a dry basis) and averaging from 1 to 2 percent of the discharge to the canal.

During normal plant operation, digester supernatant is pumped to the canal each day and imparts a black color to the water. The ranchers call water from the canal "black water" to differentiate it from the "green water" from Mitchell Lake.

The quantity of sewage in various stages of treatment diverted to the canal during 1960, varied from 206.6 million gallons in January to 1127.7 million gallons in June. The average daily diversion was 15.9 mg.



● **EFFLUENT** from the sewage treatment plant, not going into the river, is discharged into Lake Mitchell and used for irrigation. Gates regulate the lake level.

Application

Any water discharged from the sewage treatment plant which does not empty into the San Antonio River, flows through the canal to Mitchell Lake. The canal is about three miles long. From the canal and from Mitchell Lake, water is taken to irrigate more than 4000 acres of land. The water from the lake is an intense emerald green color due to the presence of algae which thrive on the organic material in the water. The lake has an area of 850 acres and varying depths up to 15 feet.

Crops Grown

The irrigated land is predominantly pasture land, with Bermuda grass the most common forage crop. These pastures are mostly broad irrigated, the water being allowed to spread out from small ditches and follow the contour of the land. One rancher has six-inch aluminum sprinkler pipe drilled with one-inch holes to effect even distribution along a hillside. When necessary, low lift pumps are used to raise the water to the required elevation. Overhead sprinkler irrigation is practiced on a limited scale with lake water. "Black water" can not be distributed in this manner due to clogging of the sprinkler heads.

Other crops which have been irrigated are:

1) Johnson grass and Sudan grass, usually cut and baled for hay. One rancher has reported three to four cuttings per year with a yield of about 2½ tons per acre for each cutting. Johnson and Sudan are also cut green to feed to dairy cattle. Local restrictions prohibit the grazing of dairy cattle directly on the land irrigated with sewage plant effluent, but do permit feeding of green hay from such land.

2) Maise, cut and baled for hay and fed green or cut for silage.

3) Oats, harvested dry or cut and baled for hay and used as a forage crop.

4) Corn, harvested dry or cut green for silage.

5) Carpet grass, which has proved to be a profitable small acreage crop.

6) Castor beans, which grew well but the farmer reported difficulty in harvesting, claiming he lost money.

7) Cotton, little grown in this area but Warrington (1) reported a 12.5 percent increase in yield of cotton on an experimental 10-acre plot as compared with a 10-acre plot irrigated with Rio Grande River water.

In general, it would seem that any crop that grows in this climate and on this type of soil, grows better when irrigated with sewage

plant effluent. In the more than 50 years that sewage has been used to irrigate the land, there has been no apparent damage done to the soil by the high salinity of the water. Although the greatest benefit undoubtedly is derived from accurate moisture control, impossible without irrigation, there are also, without question, certain benefits derived from the presence of small concentrations of plant nutrients. The continuous addition of nitrates, ammonia and phosphates stimulates plant growth, and the build-up of organic humus in the soil improves its physical characteristics.

Health Hazards

In irrigation with plant effluent, there naturally occur questions concerning the health hazards involved. Is there an occupational hazard to the men who work with this material? Is there danger of disease transmission from animals grazing on sewage irrigated lands? Are the wastes toxic to animals which might drink the irrigation water? Finally, what would be the danger of human consumption of vegetables grown on sewage irrigated land?

It is believed that with minor qualifications all of these questions can be answered in the negative, that is, the danger of using sewage plant effluent is negligible. The farmers and ranchers in this area have reported no diseases of their workers which could be attributed to the handling of irrigation water. There have been no reports in the literature showing



● IRRIGATED land is used predominantly for pasture. In 1953, when this picture was taken, all of the county, except the irrigated land, was suffering from a drought.



● JOHNSON grass yields of 250 bales per acre were obtained after irrigation.



● MITCHELL lake water must be raised to a higher elevation so it will flow to the irrigated areas. This duplex pumping station is a part of the irrigation plan.

that sewage treatment plant employees are any more unhealthy than any other class of workers.

The effect of sewage on cattle has been reviewed by Snyder (2) and the following two quotations are from this review:

In one experiment reported by Minett, Wooldridge and Sheather, three healthy cattle were allowed to consume water containing human sewage for a period of 21 months. During the experiment a cow in milk consumed 4146 gallons of sewage effluent, and for 11 months the animal drank nothing but undiluted sewage effluent. A dry cow and a yearling consumed 916 and 767 gallons of sewage effluent, respectively; this included 579 and 477 gallons of sewage effluent, diluted with water and 357 and 290 gallons, respectively, of sewage before final purification. The animals gave no sign that the fluid was distasteful to them; they thrived normally and maintained or increased their weight; the milking cow gave birth, at time, to a healthy calf while under experiment and during the subsequent fourth lactation her milk yield reached 1.8 gallons daily.

The authors drew the following conclusions: The experiment gave no support to the suggestion that domestic sewage contains constituents which are poisonous or injurious to cattle. There is, therefore, no real reason for the belief that any such condition as sewage poisoning exists. This inevitably forces the conclusion that the symptoms shown by cattle in alleged cases of sewage poisoning are due to other causes.

Crawford and Frank report a series of experiments conducted at Beltsville (Md.) Research Center by the Animal Disease Station, Bureau of Animal Industry, U. S. Department of Agriculture. The tests were made to determine the effect of raw sewage, treatment plant effluent, and sludge on swine and on plant effluent on a group of bovine animals due to disease-producing bac-

teria or viruses that might be present in any of these elements.

The swine tests were conducted as follows: Eighteen healthy swine, weighing between 45 and 85 pounds each, shown by test to be free from tuberculosis and brucellosis, were divided into three groups of six animals each. Six hog pens were cleaned and disinfected and three swine were placed in each pen. Incoming sewage and sewage plant effluent were collected in sterile 5-gallon containers three times per week and sludge was obtained about every six weeks. For a period of six months, on Mondays, Wednesdays and Fridays, 5 gallons of incoming sewage were mixed with bran and fed to swine in pens No. 1 and No. 2 and 5 gallons of effluent were mixed with bran and fed to swine in pens No. 3 and No. 4. Two quarts of sludge were mixed with bran and water and fed three times weekly to swine in pens No. 5 and No. 6. During the six-month period, each swine in group 1 received approximately 67.5 gallons of effluent. Only two batches of sludge were provided, so only about 20 feedings of sludge were made to the swine in group 3.

During the course of the experiment, the swine gained weight normally and at no time during the period of feeding did any of these animals show loss of condition or any indication of disease. Three tuberculin tests were made of the swine during the feeding period and another six months later; none showed a reaction indicative of infection. To allow for the subsequent development of any disease condition, all animals were kept in the same pens for a further period of six months. All remained uniformly well during this period. The swine were then killed and careful postmortem examinations were made of each carcass. No evidence of disease was observed. Samples of blood from each swine at the time of slaughter were tested for brucellosis, but none showed a positive reaction.

The question of the irrigation of vegetables for human consumption is a little more complex. It is common practice in many foreign countries to enrich the soil with any type of organic matter available including human feces, but in the United States the irrigation of vegetable crops with sewage plant effluents has not been looked upon with favor by health authorities. It is believed that the depletion of humus in our soils and the increasing scarcity of water in certain areas may, in the coming years, force a reversal or modification of policy on this subject. Recent experimental evidence tends to show that any real hazard to health may be slight.

Rudolfs, Falk and Ragotzkie (3) concluded after a series of experiments that there was no evidence that pollutional bacteria, amoeba or helminth eggs penetrate healthy unbroken surfaces of vegetables, causing internal contamination. Vegetables to be eaten raw can be grown without health hazard in soils that have been subject to sewage irrigation, night soil application, or irrigation with polluted water in years prior to the season in which the vegetables are grown. Vegetables grown under conditions of surface irrigation showed no higher coliform concentration than those grown on normally farmed soil. If sewage sludges or night soil are applied on the surface of the soil or sewage effluents are applied by overhead irrigation during the growth of vegetables, such application should be stopped at least one month before harvest.

The State Health Officer of the Texas State Department of Health, on June 2, 1952 made the following rule concerning vegetables to be consumed raw:

The use of raw or partially treated sewage or the effluent from a sewage treatment plant is prohibited for use as irrigation water on any food crop which might be consumed in the raw state. Such practice is the deliberate exposure of food to filth as defined by Art. 707 of our Texas Penal Code.

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3. Rudolfs, W., Falk, L. L., and Ragotzkie, R., "Contamination of Vegetables Grown in Polluted Soil." *Sewage and Industrial Wastes*, 23, 3, 253 (1951); 4, 478 (1951); 4, 656 (1951); 6, 739 (1951); 7, 853 (1951); 8, 992 (1951).

Efficient Sheetin Techniques

Speed Marina Bulkheading

THE CONTRACTOR building bulkheads for a new marina on Bridge Bay Lagoon in Yellowstone National Park got off to a fast start by developing efficient techniques to align and drive lightweight steel sheet piles.

One method developed by Charles M. Smith, general contractor, Thermopolis, Wyoming, is to hang a work platform for a two-man pile-driving crew from the cable supporting the pile hammer. Another is to drive completely every eleventh and twelfth sheet to design grade; then tack weld them to a steel wale for perfect alignment. To maintain alignment of the box-type corrugated sheets, temporary timber piles were driven on 15-ft. centers to hold 2 x 8-inch knee-bracing against the sheeting.

Since Department of the Interior engineers specified Foster 1210 lightweight steel sheet piles, the contractor was able to reduce the size and capacity of his pile driving equipment. As LBF 1210 specifies, each sheet pile is 12 inches wide and made of 10-gage material.

Maintaining Alignment

Driving the 20-ft. pile sections was handled as follows: After excavating along the 1,146 linear feet of bulkhead alignment to remove muck and provide for tie rod installation, Smith drove and erected the timber piles and knee bracing.

Then ten sheets were partially driven along the wall with a McKiernan-Terry No. 2 hammer on a Koehring 305 crawler crane. The next two sheets were driven to final grade and tack-welded to the top wale which consists of a 10-in. steel channel. This technique efficiently maintains alignment as sheets are driven; and also permits lining up an entire stretch of bulkhead.

Later, all raised sheets were quickly driven to final grade with a heavier hammer as the two-man crew rode along on the suspended work platform.

The exposed 10 feet of bulkhead sheeting was braced by two outside wales. Placed in maximum 30-ft. lengths, the upper wale was field spliced by welding plates over joints. It was also connected to the bulk-

head by welding both flanges to all flat sheeting surfaces. Two 3-in. channels placed back-to-back and held apart by plates welded on 5-ft. centers formed the bottom wale section. Both top and bottom wales were tied back to a 12-in. treated-timber deadman laid 16 ft. behind the bulkhead.

To form a railing atop the running cap, 4 WF sections 34 ins. long will be welded on 8-ft. centers. These will be connected by three bolted channels to form a continuous railing.

Donald Christianson and Ben Keller are supervising the project for the general contractor.



● CRAWLER crane supports 2-man platform while driving lightweight steel sheet piles. Every 10th and 11th pile was to final grade; others were only partly driven.



● ARTIST'S drawing of completed Bridge Bay Marina in Yellowstone National Park.

Refuse Collector "Doubles" in Snow Removal



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Snow is dumped into compaction body.



Huge cube was once traffic-clogging snow.



NEWS BULLETINS

AMERICAN PUBLIC WORKS ASSOCIATION, 1313 EAST 60th STREET, CHICAGO 37, ILLINOIS

Director of Space Administration To Address APWA Banquet

Chicago, Ill.—The 1961 Public Works Congress and Equipment Show, to be held in Minneapolis, September 24-27, offers public works engineers and administrators the best educational opportunity of the year. Over 100 exhibitors will display a wide variety of equipment, materials and supplies at the exposition in the Municipal Auditorium. Nearly 100 persons will participate in the action-packed program. Several new motion pictures will be premiered at the APWA Theater and sparkling entertainment, featuring an ice carnival awaits those who attend this year's meeting.

Headline speaker for the Association's 67th Annual Banquet will be James Webb, Administrator of the National Aeronautics and Space Administration, who was Chairman of the Municipal Manpower Commission prior to being selected by President Kennedy for his present position. Webb formerly served as director of the U. S. Bureau of the Budget, and was Under Secretary of State from 1949 to 1952. He has held many other important positions and has received honorary degrees from Notre Dame, Syracuse, George Washington, and North Carolina Universities. Minnesota's Governor Elmer Anderson will also appear on the banquet program and extend

greetings to the delegates and their wives.

Another highlight of the program will be a luncheon address by Rex M. Whitton, Federal Highway Administrator, on Tuesday, September 25. Whitton, who formerly served as Chief Engineer of the Missouri State Highway Department, likewise holds many honors and was selected as one of the "Top Ten Public Works Men-of-the-Year" for 1960.

Theme of this year's Congress is "Better Service and Lower Costs Thru Research and Development". Its diversified program includes technical papers on a wide variety of topics from "Street Lighting Trends and Developments" to "Scientific Analysis of Sanitary Landfills". It also includes a "Workshop on Identification of Research Needs"; Consultation Clinics, and a "Workshop on Administrative Problems" featuring an address by

Herman Pope, Executive Director of the Public Administration Service of Chicago. Another highlight of the program is a panel on "Metropolitan Public Works Problems" on Wednesday afternoon. Ross L. Clark, Commissioner of Works of Metropolitan Toronto Corporation, will moderate the discussion. Others on the panel are: Dr. John Logan, Chairman, Civil Engineering Department, Northwestern University; Henry Barnes, Commissioner of Transit and Traffic, Baltimore, Md., Kerwin L. Mick, Chief Engineer, Minneapolis-St. Paul Sanitary District; Harmer Davis, Director, Institute of Transportation and Traffic Engineering, University of California; and Gerald Remus, General Manager, Board of Water Commissioners, Detroit, Mich.

For hotel reservation forms and further information, write to the American Public Works Association, 1313 E. 60th Street, Chicago 37, Ill.

"Top Ten" Public Works Officials Awards

Again this year Kiwanis International and the American Public Works Association will join in selecting the ten public works men of the year. Awards will be based on accomplishments. Officials on the national, state, county and local levels are eligible. Nominations are necessary and these must be made by August 15 through local Kiwanis Clubs or by application to the APWA, 1313 East 60th St., Chicago 37, Ill. Announcements of those selected will coincide with the 1961 National Public Works Week, October 1 to 7, and each of the ten will receive plaques.

OFFICERS: Frederick W. Crane, Buffalo, N. Y., President; Albert G. Wyler, New Orleans, La., Vice President. **REGIONAL DIRECTORS:** (term ending 1961) Louis H. Moehr, Wyandotte, Mich.; John A. Morin, Oakland, Calif.; Roy W. Morse, Seattle, Wash.; (term ending 1962) Paul R. Screvane, New York, N. Y.; Manon P. Phillips, Augusta, Ga.; Edward J. Booth, Bismarck, N. D.; (term ending 1963) George J. Maher, Lewiston, Maine; Robert S. Hopson, Richmond, Va.; Harlan H. Hester, Fort Worth, Texas. **Immediate Past President**, Jean L. Vincenz, San Diego, California. **Robert D. Bugher, Executive Director.**

Transportation Planning Seminar

Richmond, Va.—Transportation in large American cities reached a critical stage at least 10 years ago. Since then, the problem has grown increasingly complex and is now pre-empting the attention of national and state as well as local leaders.

In medium and smaller communities, however, the crisis is yet to come. Solutions can still be found without extensive disruption of the community—if aggressive planning and development programs are undertaken without delay. Leadership for these programs must come from the local official, usually the Public Works Director.

These were major points made by Willard F. Babcock, North Carolina's Director of Highways, key-

noting the APWA Seminar on Planning and Programming Urban Street Construction recently held in Richmond, Virginia. The first of a proposed regional series, the two-day seminar was attended by local, state and Bureau of Public Roads officials from five states surrounding the Richmond area. Several communities were represented by their transportation planning team—Public Works Director, Traffic Engineer and City Planner.

Planning study techniques were discussed during the first day and again in small discussion groups during the evening. Speakers gave case examples of the application of National Committee on Urban Transportation studies in several cities. Land use studies and the contribution of city planning techniques toward developing a sound plan were also detailed.

The importance of classifying the street system and establishing functional standards for each class was stressed. Again, in the words of the keynoter, the problem is not "What right of way is available?" The problem is "What capacity is needed?"

The final session was devoted to "Carrying Out The Plan." John Bailey, Executive Director, Urban Traffic and Transportation Board, Philadelphia, and Chairman of the APWA Committee on Transportation, discussed approaches to financing and implementing a program. Other speakers dealt with establishing priorities, gaining public support and keeping a plan up to date.

Other speakers included Arthur Row, Philadelphia; Allan Voorhees, Thomas Deen and Donald Loutzenheiser of Washington; Marble Hensley, Chattanooga; Henry

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OCT. 20, 1952: 4" SNOW—WILKES-BARRE-SCRANTON, PENN.
OCT. 10, 1954: 6" SNOW AND SLEET—CLEVELAND, OHIO
OCT. 25, 1955: FREEZING RAIN—CHICAGO AND DETROIT
OCT. 24, 1956: 3" SNOW, FREEZING RAIN—SOUTH DAKOTA
OCT. 18, 1959: 3" SNOW—NORTHERN NEW ENGLAND

(Source: U. S. Weather Bureau
Climatological Data)

A large, bold, black number "1961" is centered within a thick, dark gray circle. The circle has a smaller circle cut out from its upper right quadrant, creating a stylized "19" shape. The "61" is positioned to the right of this cutout.

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Barnes, Baltimore; and John P. Mills, Jr., Richmond.

The next seminar, on this subject planned by the American Public Works Association, will be held in the mid-west during the coming Fall. Other regional meetings to follow will be announced by mail to interested city and state officials.

Members of the APWA Transportation Committee, which is sponsoring the Seminars, in attendance were David W. Schoppert, Secretary; Clifton G. Stoneburner, D. Grant Mickle and John A. Bailey, Chairman.

Boyce to Serve as Technical Adviser on Research Study

Chicago, Ill.—The Chairman of APWA's Research Foundation, Samuel S. Baxter, of Philadelphia, Pa., has announced plans for conducting the Ford Foundation financed study of research needs in the field of public works. It will be carried out by a special committee which is now being organized. The Association's Executive Director, Robert D. Bugher, will serve as manager of the project and handle the coordination and administrative phases of the study.

Professor Earnest Boyce, who recently retired as Chairman of the civil engineering department of the University of Michigan, will serve as technical adviser and carry out special phases of the investigation. Professor Boyce has had many years of experience in the sanitary engineering field and will be able to contribute a great deal to the success of this project. He formerly served as chief engineer of the Kansas State Board of Health and was also professor of sanitary engineering at the University of Kansas. He was an officer in the U. S. Public Health Service during World War II and joined the University of Michigan staff in 1944 as Professor of municipal and sanitary engineering. He has served as a consultant to the World Health Organization and International Cooperation Administration, working on assignments in India, Mexico, Indonesia and other countries throughout the world. He is a past president of the Water Pollution Control Federation, a member of the APWA and a life member of the ASCE, AWWA and APHA.

David J. Vargas has been appointed director of research and will devote full time to this project,

working directly under Bugher. Mr. Vargas, a graduate civil engineer from the University of Michigan, earned his master's degree in sanitary engineering from the University of Washington and has served as assistant city engineer of Pocatello, Idaho for the past year. He is married and has two children.

Additional staff assistance will be provided, under contract, by the Armour Research Foundation of the Illinois Institute of Technology. Special consultants, such as Herbert Fritz, former assistant director of the Association and more recently city manager of Grand Junction, Colo., Lexington, Ky. and Peoria, Ill., will also be utilized on this project from time to time.

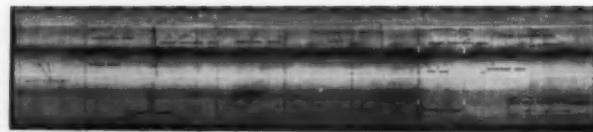
New York-New Jersey Metropolitan Chapter Meets in Historic Princeton

Princeton, N. J.—A large exhibit of equipment, technical sessions and inspection trips were featured at the well-attended Spring meeting of the New York-New Jersey Metropolitan Chapter on June 16. More than 40 manufacturers of equipment and materials displayed their products at the Princeton

TWO NEW HIGHWAY INVENTORY TOOLS

SUR/FAX →

is a newly developed system of photographic recording, inspection and analysis of highway surfaces. It is superior in detail and dependability to previous methods of highway evaluation. It records cracks of all types, scale, spalling and faulting of rigid pavements, and alligator-type or other cracks, raveling, rutting and bleeding for flexible pavements. Sur/Fax saves time, labor and money by reducing the need for lengthy field inspection. It is a permanent record, consistently objective and accurate. The film strips can be projected for in-office study.



PHOTO/FILE →

photo-records highways and appurtenances as seen from the driver's point of view. A special road unit, traveling at speeds up to 50 mph, records on 16mm film, at 1/100th mile. Photo/File is useful for many purposes—such as sufficiency surveys, as-built surveys, channelization and encroachment studies.



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AERO SERVICE CORPORATION
210 E. Courtland Street, Philadelphia 20, Pennsylvania

University Armory, which was also the site of a buffet luncheon and three concurrent technical sessions.

The session on "Emergency Pavement Repairs," was moderated by Curtis C. Colwell, former county engineer, Essex County, and discussed by Alvin L. Ruefer, managing director, New Jersey Bituminous Concrete Assn.; Quinton Kiepe, engineer, Portland Cement Assn.; Ralph G. Caprio, superintendent of streets, Newark; and Ralph Stelljes, pavement engineer, New Jersey State Highway Department. A second panel considered sewer inspection by color photography and closed circuit television. Peter Homack, consulting sanitary engineer; Frank E. Peruggi, municipal engineer, Fair Lawn; and Ronald Wingerter of the New Jersey Testing Laboratories formed the panel, with Professor Steven M. Slaby of Princeton University as moderator. In the final session the topic was "City Planning and Its Relation to Public Works." This was moderated by William Holster, city engineer and manager of Clifton and discussed by Dr. Edward B. Wilkens, Professor of Regional Planning, Rutgers University; and B. Budd Chavooshian, chief of the Bureau of Planning, State of New Jersey.

Inspection trips were made by bus to the Princeton incinerator and sewage treatment plant and to the Kingston Trap Rock Quarry.

Ladies who accompanied their husbands to the meeting were entertained at a special luncheon, a style show and a tour of "Morven," a Revolutionary War home which is now the New Jersey Governor's Mansion.

Harry Hershfield, president of the Saints and Sinners of New York, served as toastmaster following the dinner at the Princeton Inn. Members and guests were welcomed by Mayor Raymond F. Male and by Arthur T. Brokaw, borough engineer and president of the local chapter.

Street Lighting Discussed By Southern California Chapter

Los Angeles, Calif.—The June meeting of the Southern California Chapter was held at the Los Coyotes Country Club and featured a discussion of "Street and Highway Lighting" by Oscar Meissner, Director, Bureau of Street Lighting, City of Los Angeles; Dick Stanford, Street Lighting Division, Los Angeles County and C. C. (Chuck)

Flink Spreaders do the Job!

WHATEVER... The Spread—Chlorides or Chips

WHOEVER... The User—Government or Private

WHEREVER... The Job—Town or Country



Flink HDWS4 Completely Hydraulic Tailgate Spreader—A fleet of these efficient rigs help keep traffic rolling on the Illinois Tollway! Left-rear spinner permits easy 2-3 lane spreads in one pass; saves material. Hydraulically operated, cab-controlled, 2-speed auger permits instant change from abrasives to straight rock salt. Volume controlled by hydraulically operated feedgate.



Flink LMC Hopper Spreader—Handles salt, cinders and sand for heavy-duty ice control. Pea gravel and chips for seal coating. Choice of PTO, hydraulic or gasoline engine drive, cab-controlled. Uses the only power transmission of its kind in the field. No worm gears, no "out-of-straight" shafts of U-joints. Differential equalized drive.



Flink HD42 Hydraulic Drive Tailgate Spreader—Consistently picked by smaller communities that need both faster ice control and seal coating in the same low-cost rig! Self-feeding. Handles all Chlorides and abrasives. Spreads from width of truck to width of street, thick or thin. Replaces tailgate on present trucks. Trips for dumping just as original tailgate did.



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**FOR FAST, LOW-COST
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Reversible or one-way plows for 1½ to 5 ton trucks and up. Sectional or one-piece, full-length cutting edge trip. Exclusive blade-hinge weldments in place of hinges cut maintenance. Full 3¼" wear on a 6" cutting edge. Operating position adjustable 65° or 75° from horizontal.

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Allen, Southern California representative of the Line Material Company.

In a business meeting following the dinner, Lyall Pardee, City Engineer of Los Angeles was elected 1st Vice President of the Chapter, succeeding C. C. Westmoreland of the Southern California Gas Company who was transferred to the Company's Northern district.

The Chapter's Executive Committee reports that its Model Street Excavation Ordinance, issued in 1959, is being revised and that a draft will soon be ready for distribution to governmental agencies in the Chapter's jurisdiction.

Washington Chapter Issues Fifth Construction Standardization Report

Seattle, Wash.—One of the highlights of the June meeting of the Washington State Chapter was the presentation of the Fifth Construction Standardization Report. Committee Chairman Robert G. Anderson, City Construction Engineer of Tacoma, said that they hope to complete the project by early 1962.

The Standardization Committee is made up of engineers, contractors,

material men and other representatives of various organizations allied with the construction industry, and totals some fifty individuals. The general committee is divided into several subcommittees, one for each subject to be covered in the specifications. Personnel of these subcommittees represent the very best talent available in each particular field.

Assistance given this project through the Association of Washington Cities and the State Highway Commission has provided the services of Guy G. Harvey, who is now engaged in the editing and co-ordinating required for the compilation of a workable set of municipal construction specifications.

The Chapter's program included a tour of the site and construction of the 1962 Century 21 World's Fair in Seattle. Of particular interest was the initial stages of construction of the highspeed monorail from the downtown area to the site of the Fair. W. A. Bugge, Director of Highways, gave a talk on "The Washington State Freeway Progress Report". Other topics discussed were "Seal Coating of Streets"; "Concrete Slip Form Paving" and "Motor Pool Facts and Figures".

Incinerator Planned for Garden City

Plans have been essentially completed by William Raisch, consulting engineer, for an incinerator for Garden City, N. Y. The new plant will have a capacity of 175 tons per day and will have the most modern equipment to insure operation with efficiency and the control of smoke and fly ash. Construction will be on a site adjacent to the existing incinerator which has been in service for nearly 30 years. Bernard J. Gorman is Superintendent of Public Works of Garden City.

Thin Water Film Distillation

The thin film water distillation process recently announced by General Electric now appears feasible for municipal applications, as a result of recent tests conducted for the Office of Saline Water. With this distillation process, according to GE engineers, salt or brackish water is wiped in a very thin film over the inside surface of a heat transfer tube. Heat from steam passing over the outside fluted surface of this tube causes the inside film of feed water to evaporate. The vapor produced is then condensed.

THE THERMAL SNOW MELTING SYSTEM

THE ONLY SYSTEM OFFERING THE ULTIMATE IN
ECONOMY, EFFICIENCY AND FLEXIBILITY... AT
A FRACTION OF THE COST OF TRUCKING!

Photo courtesy of The Port of New York Authority



Shown is a 25 ton per hour stationary installation at La Guardia Marine Terminal being fed by bulldozer.

Proven by 3 years of successful service, the THERMAL Snow Melting Systems are designed for airports, parking lots, service stations, shopping centers, railroad yards, and other areas where snow accumulation presents a real problem. For example, 25 tons per hour of snow can be disposed of for less than \$7.00 per hour worth of fuel and power. Compared with usual trucking methods this can be a saving of more than \$50.00 per 25 tons of snow.

THERMAL Snow Melting Systems are available in 3 styles. Stationary, with the equipment permanently mounted in a melting pit. Semi-Mobile, in which the equipment is trailer mounted and can be moved from one pit to another. Mobile, in which a melting tank, on a trailer, replaces the pit and allows complete mobility.

For information, write for Bulletin #118

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In digging like this no other excavator compares in productivity with a modern wheel-type trencher. Take a second look at that spoil bank. That's hard shale and rock-digging, right down to trench bottom. Piling up that spoil at a 4-foot-a-minute clip is a tough Cleveland J-40.

There are fundamental reasons why full-crawler, wheel-type trenchers like this—the trencher originated and perfected by Cleveland—are unequalled for trench production in hard digging.

The wheel is the strongest type of digging element and the stability of the full-crawler mounting permits maximum exploitation of its digging ability in continuous digging action. Simultaneous wheel rotation

and crawler progress result in constant forward crowd of the wheel into the work with maximum utilization of power at the point of digging.

Higher wheel-speeds in relation to crawler-travel produce a fast-biting milling action that is most effective for digging shale, frost and similar conditions. Slower wheel-speeds produce powerful bites that forcefully chew out caliche, hardpan, coral and other hard formations. The continuous-digging, crawler-mounted, wheel-type trencher digs trench in all such conditions faster and more economically than excavators dependent on interrupted-cycle digging action.

Investigate now the profit potential of a modern trencher—a tough, fast, dependable Cleveland Trencher.



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PUBLIC WORKS for August, 1961

127

THE
HIGHWAY
AND
AIRPORT
DIGEST



Prepared by L. G. BYRD, Associate Editor

**Pot Torch
Storage Box**

Maintenance personnel in District 12, Houston have designed and built a bomb-torch box to house torches for icy weather conditions. These boxes are equipped with two torches, a piece of sandpaper, and a box of matches wrapped in plastic. Constructed of two muffler clamps and pieces of five-eighths-inch plywood salvaged from old signs, the material and labor together cost less than \$3 per box. The major advantage to the use of the boxes is the saving in time, man power and equipment. Formerly, when conditions required the use of torches, a crew of men and a truck loaded with torches were dispatched to distribute and position the torches. Now, with the torches stored at the sign locations, two men in a pick-up truck can rapidly set them out in a substantially shorter period of time.

"Bomb Torch Storage Box,"
Trudy E. Carter, Junior Office Assistant, District 12, Texas State Highway Department. *Texas Highways*, June, 1961.

**Highway
Signing**

Signs on high-speed highways must be clear, concise and easily read from a distance. Often times the structural design is an easier engineering problem to resolve than is the selection of the community names to be used. A strict state policy limits names to two or no more than three at an intersection. Selection is based on prominent areas or facilities significant to the traveling public. Community size has no bearing. When distance between interchanges permit, a two-mile advance sign is placed to allow about 3-minute warning time for the driver to discuss the move-

ment and possibly even stop on the shoulder to consult a map. A one-mile sign follows with a duplicate of the first message. At the beginning of the deceleration lane the third sign is located bearing the same message with the addition of a vertical sloping arrow. With 16-in. high capital letters and 12-in. lower case, signs vary in width from 12 ft. for short names to 35 ft. for names like *George Washington Bridge*. Heights vary from 6 to 9

ft. These large signs require sound mounting structures designed for windloadings up to 85 mph. New Jersey has been using plastic-coated plywood for directional signs for five years with excellent results. In keeping with the policy used for Federal Interstate signing, New Jersey does not use a reflectorized background except on non-illuminated overhead signs. Tubular aluminum is used for ground-mounted supports and steel or aluminum for overhead structures. The George Washington Bridge with the new lower level requires a very complex interchange being built in stages. Temporary signs are being used until final construction stage is reached at which time a separate sign contract, expected to run about one-half million dollars, will be let.

"Signing New Jersey Roads," Wilfred Watson, Sign Engineer, New Jersey State Highway Department, Trenton, New Jersey. *Civil Engineering*, June, 1961.

**Advanced
Techniques**

An AASHO Committee on Electronics "Questionnaire on Advance Techniques" was distributed to all member highway departments last year. Completed questionnaires were returned by 46 states plus the District of Columbia and Puerto Rico. Answers for the 4 remaining states were developed in part by the Electronics Branch of the Division of Development of the Bureau of Public Roads. In response to a question about the extent of usage of electronic computers, the 38 departments having computers and offering applicable answers showed an average production usage of 36 hours per week and program development usage of 8 hours per week. Forty-two states and Puerto Rico are now using computers and the remaining 8

Flexible Highway Guard



A FLEXIBLE highway guard manufactured by the Berlin Chapman Co., Berlin, Wis., differs from conventional construction in that the cable supporting posts are not rigidly installed. Instead the posts move under impact to cushion the shock yet provide fully adequate resistance. The cable supporting units may be spaced at 25, 30 or 35-ft. intervals. At a recent test demonstration witnessed by highway and safety officials, a driver crashed into the guard at speeds up to 55 miles per hour without being hurt.



Digs rock...lays pipe...backfills

In 25 hours, Michigan handles entire 650 ft sewer job for City of Columbia

"In the two seasons we've owned our Michigan Model 55A Tractor Shovel, we've used it economically—and successfully—on just about every maintenance-type job you can imagine," reports Public Works Director Morris Thurman, Columbia, Tennessee. "It's dug ditches and pipe lines... truck-loaded dirt, gravel, asphalt and other bulk materials... ripped old paving... spread bituminous material for street repair... graded and leveled."

An example of one of the Michigan's more dramatic assignments was the recent laying of a 10-inch sewer line in 90% rock. Equipped with a Michigan Snap-Mount Backhoe, the 66 hp Tractor Shovel did the entire job by itself.

First the Michigan used its 1 yd tractor shovel excavating bucket to scrape away surface material so the rock ledge could be drilled and shot. Next came trench excavation, the Michigan backhoe digging out both shot rock and adjacent hard-packed clay. Then, using the hoe's 180° swing boom, the Tractor Shovel assisted workmen in hoisting and laying the concrete pipe. Next came backfilling and soon, with the machine's big tires rolling over the

loose material, the desired compaction. In all, only 25 work hours had elapsed—yet the 650 ft long, 5 ft deep line was completed.

Backhoe on or off in a minute

"One of the best features of the Michigan is this versatility," says Mr. Thurman. "We also like its mobility... plus the fact that one man can attach or detach the backhoe in less than a minute... without tools. This permits the Michigan to work on other jobs right up to the minute we need the backhoe. For example, it truckloads stockpiled asphalt, a one yard bucket-full every 20 seconds." And, with power steer, hydraulic brakes, horn, lights, parking brake, torque converter and power shift transmission (standard equipment on all Michigans), this Tractor Shovel has proved easy and safe to operate everywhere.

Investigate the 26 mph, 1 yd Model 55A for yourself. It's designed especially for city work—and city budgets. It has good digging power and a wide variety of attachments. Your Michigan Distributor will be glad to demonstrate one on your job—or to show you any

of the larger Michigan Tractor Shovels (buckets up to 12 cubic yards).



Michigan Snap-Mount Backhoe

Can be attached (or detached) by one man in 30 seconds... without tools. Digs 12' deep, 12" to 36" wide. Can be combined with wide variety of quickly-interchangeable front-end attachments: sprinkler-type pick-up sweeper; crane hook; fork lift; scarifier; blower; "V", straight snow plows; broad range of buckets.

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states and the District of Columbia are studying such use. More than half of the departments are planning to upgrade their computer systems. 13 states are now using digital cross sections in lieu of drawn cross sections; 9 states are using tabulating equipment for mechanical plotting from punched cards; 8 states are using automatic data recording equipment for direct entry into computers of cross-section data from aerial photographs or topographic maps. Usage by 44 states of aerial photography for reconnaissance, 25 states of which have their own personnel and

equipment, indicates the diminishing use of conventional ground surveys. Widespread use was reported of aerial photographs for determination of soil types and subsurface conditions, supplemented by electrical resistivity or refraction seismic equipment. Electronic distance measuring devices are being used by 20 states and many are employing non-destructive testing methods and spectroscopy.

"Highway Department Usage of Advanced Techniques." William B. Huffner, Procedures and Operations Branch, Division of Development, Bureau of Public Roads.

A report issued by the Bureau of Public Roads in April, 1961.

Roadside Maintenance

In Massachusetts, roadside development in new construction is accomplished by a separate contract. Planting is planned to eliminate large areas requiring mowing, to control erosion, conserve water and to improve the appearance of the roadside. In addition to seedlings and vines as ground covers, trees and shrubs are planted to break up bare, open areas and reduce mowing. Weed control is an important roadside maintenance program. Massachusetts has been using chemical weed killers since 1951, first to eliminate poison ivy, then to increase sight distance and reduce mowing. Through control of weeds, a uniform growth of grass, even though above normal height, still presents a satisfactory appearance. Along the 900 miles of guard rail a soil sterilant is applied on a two-foot wide band. It is estimated that each hour of chemical spraying eliminates 80 hours of hand mowing along the guard rail. Mowing by contract has been successfully practiced in Massachusetts and practical specifications have been developed. Chemical growth retardants have also been used to reduce the frequency of mowing and the resultant program costs.

"Roadside Maintenance." Joseph L. Beasley, Highway Landscape Supervisor, Massachusetts Department of Public Works. A paper presented at the First Annual Massachusetts Highway Conference in Boston.

Characteristics of Passenger-Car Travel

Among the factors important to an accurate analysis of the benefits accruing to passenger-car users through highway improvements are the average overall rates of fuel consumption and speed by type of road, the effects of traffic impediments, the relative attractiveness of the different types of highway improvement benefits to motorists, and the value to motorists of time saving and increased driving comfort. Data useful to passenger-car benefit studies in connection with each of these factors were obtained in 1959 during the operation of a passenger vehicle on 8,000 miles of primary highways in 17 States. These data included rates of fuel consumption, overall speeds, speed changes identified by cause, and



protected by a MIRO-FLEX SAFETY SUEI



School Stop Lane



Crosswalk Sign



School Slow Lane



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From the moment Miro-Flex's Safety Sue is on the job, she protects this nation's most vital resource — our most valuable possession — our children. This portable school warning sign is a silhouette type with fully embossed 30" x 20" zinc-coated, Bonderized steel panel. Miro-Flex signs are embossed for extra strength and rigidity as well as increased legibility. For safety's sake buy premium quality Miro-Flex embossed signs. Competitive makes are... rarely as attractive... never so enduring.

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Standard Traffic Signs Available for Immediate Delivery at Northeastern Warehouse
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END THE WORRY OF COSTLY ACCIDENTS!



Replace old-style loaders NOW with Safety-Engineered CASE rigs!

If you own *any* 4-wheel-drive loader that is *more than 3 years old*, or even some of later design, you can reduce the risk of serious accidents — and gain increased output as well — by trading now for modern *safety-engineered* loaders built by J. I. Case. You see, Case pioneered the "safety concept" in 4-wheel-drive loaders, by introducing a line of machines with *greatly improved balance and stability* — plus *forward-pivoted lift-arms* — that positively eliminate the major causes of accidents experienced with earlier competitive models. As a result, safety-minded owners everywhere are switching to Case, for extra "peace of mind" — and also for those *extra yards of output* that result when an operator can concentrate on his work, instead of his machine.

Four sizes to choose from — safety-engineered Case loaders are now available in three, job-proved, 4-wheel-drive models:

- **5500-lb capacity W-9** with $1\frac{5}{8}$ to $2\frac{3}{4}$ -cu yd buckets;
- **6500-lb capacity W-10** with 2 to $2\frac{7}{8}$ -yd buckets;
- **9000-lb capacity W-12** with $2\frac{1}{2}$ to $3\frac{1}{2}$ -yd buckets.

You also get similar advantages with the thrifty, two-wheel-drive • **3000-lb capacity W-5** with 1 to $1\frac{1}{2}$ -yd buckets.

Ask your Case Industrial Dealer for full information on Case operating advantages and finance-lease plans. Or write directly to Dept. H1341, J. I. Case Co., Racine, Wis., for free literature.

CASE.

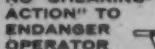
J. I. CASE CO., RACINE, WIS.



COMPARE YOUR MARGIN OF SAFETY!

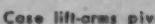
CASE LOADERS

NO "SHEARING-ACTION" TO ENDANGER OPERATOR



Rapid scissor-action of lift-arms — on both sides of operator — creates constant and distracting hazard.

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Operator can see in all directions, at all times. There are no dangerous "blind spots" to block vision.

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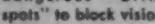


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Improper balance can cause rig to nose-dive or tip sideways — especially on soft ground, bad grades.

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OBSTRUCTED EXIT



Operator can open cab doors and "bail out" in a hurry — even with lift-arms fully raised.

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PORTABLE
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Permits a complete moisture and density test in less than 5 minutes. TESTlab system incorporated improved portable scaler and is half as heavy as other systems. Densities by direct transmission.

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Surface Moisture Gage and Scaler. System illustrated weighs 34 lbs.

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**Rugged, Low Cost Ditcher
Digs 6"-14" Wide, 4½' Deep**

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records of all traffic impediments. The study route included 14 sections of toll route where drivers traveling between two particular points have a choice between use of a modern controlled-access toll route or an alternate free route of lesser design quality. At each of these comparison sections, vehicle data were collected for trips on both the toll and free routes. In addition, interview stations were operated on each of the alternate routes to obtain information from the drivers using them. This report presents the findings of the study, including the average overall rates of fuel consumption and speed on major existing highways and on toll routes and the variation in these overall rates as affected by the frequency of driveways and cross roads, as well as the effects of traffic impediments on passenger-car operation. The report also shows the proportion of passenger-car users electing to use the toll route at each of the 14 toll route comparison sections, and the relative attractiveness to users of the types of benefit realized on both the toll routes and free routes. Finally, the data collected at the toll route comparison sections were subjected to a separate analysis to obtain estimates of the value to motorists of the time saving and increased driving comfort achieved through highway improvements.

"Characteristics of Passenger-Car Travel on Toll Roads and Comparable Free Roads for Highway User Benefit Studies," Paul J. Claffey, Highway Research Engineer, Traffic Operations Division, Bureau of Public Roads, Public Roads, June, 1961.

Moisture Content Determination

A rapid, reliable method of determining soil moisture content in the field with a simple, portable apparatus is an important need in highway engineering. A commercially made device for this purpose, which shows great promise, measures moisture content indirectly by gaging the pressure of gas generated when calcium carbide reacts with the moisture in a small soil sample. Tests of the apparatus are described in this article, which includes calibration curves for relating the gage readings to moisture content derived by the oven-drying method. Test results varied with the time of mixing of the calcium carbide and soil, and a 3-minute mixing time is recommended. Time-temp-

COMPACTON CLINIC

How mobile, multi-purpose Duo-Pactors are cutting costs for street and highway maintenance departments



The advantages of *one* investment, *one* operator, *one* machine to maintain for *all* compaction and surface rolling jobs, are evident. That's one reason why the Seaman Duo-Pactor is finding wider use among county, municipal and state highway departments.

But there are other and even more important advantages: Quality of compaction is improved. The Duo-Pactor provides narrow spacing between the tires of the pneumatic roll. This confines materials, preventing displacement and assures higher, more uniform densities in fewer passes than required with the average rubber-tired compactor. For this reason, the Duo-Pactor makes possible high-yardage, high-density compaction of stabilizations, gravel and crushed stone bases—even sand. Then, level, compact, and finish the surface with the steel roll.

For seal-coating, the Duo-Pactor with its narrow-spaced tires pro-



Model 10-30 RD Duo-Pactor compacting base for city street extension

vides complete rubber roll coverage in fewer passes, at speeds to 10 mph.

Faster, more durable patching of chuck holes and repair of frost boils results from Duo-Pactor design: The closely spaced, small-diameter tires with torsion spring mounting densify patching materials, even in small holes that would be bridged by larger tires. Then, with the hole filled and compacted by rubber, just lower the steel roll to level the material flush with the surrounding surface. One job finished, drive the Duo-Pactor to the next location, carrying equipment and supplies.

DUO-PACTORS

Duo-Pactors—rubber and steel rolls combined in one low-cost machine—are available in sizes with ballast variable from 7 to 20 tons, 9 to 27 tons, and 10 to 30 tons. In addition, compressive pressures can be varied by on-the-go hydraulic adjustment of the wheel base. The 10-30 RD model is equipped with dump body for quick ballast adjustment or for use as a highway or off-highway materials hauler.



Note imprint of Seaman Tri-Pactor's heavy vertical vibratory impact, rolling over previously compacted hard clay subbase for airport apron paving.

TRI-PACTORS

Where construction and maintenance conditions require vibratory impaction in addition to compaction with rubber and/or surface rolling with steel, the Seaman Tri-Pactor provides *all three* in one low-cost, self-propelled unit. One state highway maintenance department recently ordered its third unit. Tri-Pactors are available in models with ballast variable from 8 to 20 and 10 to 27 tons. Just touch the hydraulic control and convert the steel roll from a static surface roll to a deep-impact, vibratory roll delivering from 600 to 1,400 vertical impacts of up to 25,000 pounds per minute.

Please send me Specification Sheets as checked below:



- | | |
|--|--|
| <input type="checkbox"/> 7-20-ton Duo-Pactor | <input type="checkbox"/> Pull-type Vibratory Impactor |
| <input type="checkbox"/> 9-27-ton Duo-Pactor | <input type="checkbox"/> Self-Propelled Vibratory Impactor |
| <input type="checkbox"/> 10-30-ton Self-dumping Duo-Pactor | <input type="checkbox"/> Utility 6-yd. Scraper |
| <input type="checkbox"/> 8-20-ton Tri-Pactor | <input type="checkbox"/> Bituminous Distributors |
| <input type="checkbox"/> 10-27-ton Tri-Pactor | <input type="checkbox"/> Street Flushers |

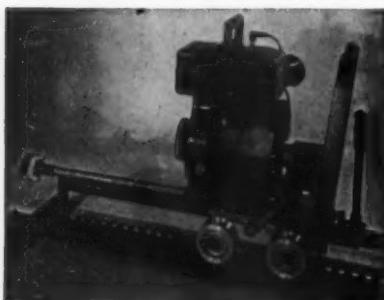
(M/B) Sweepers Work Faster than Aspirin for Relieving Snow Removal Headaches!



When snow is 6" to 10" in depth, the easiest, fastest, most economical method of removal is an M/B Sweeper. Leave big, expensive truck plows in the garage, for a low-cost tractor-sweeper combination easily cleans snow from streets, parking lots, airport runways, playgrounds, skating rinks, etc. There's an M/B Sweeper to fit most popular tractors or loaders—choice of two-way angling with hydraulic drive or low cost, fixed angle, mechanical drive. Solve the snow headache now—see your tractor dealer, or write the M/B Corporation, New Holstein, Wisconsin, Dept. PW.



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Underground Boring
Machine
New! Improved!**



Model 70

- **BORES**—with no surface break
 - **BORES**—up to 250 feet in length
 - **BORES**—up to six inches diameter
 - **BORES**—so drill stem of pipe or conduit stays
 - **BORES**—1,000 feet on 1 Gal. of gas
 - **REAMS**—up to 12 inches diameter
- Write immediately for information.*

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fibres**

Wide variety of domestic and imported fibres. Large or small filled immediately from huge warehouse stock.

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Hatfield, Penna.

erature relations of the chemical reaction were observed, but no significance in this relation with respect to moisture content was found.

"Moisture Content Determination by the Calcium Carbide Gas Pressure Method." Jerome R. Blystone, Adrian Pelzner and George P. Steffens, Highway Research Engineers, Division of Physical Research, Bureau of Public Roads, Public Roads, June, 1961.

**County Road
Stabilization**

Calcium chloride has been used by Iowa counties in their improvement and maintenance programs. Linn County, with 1200 miles of secondary roads and traffic counts up to 2700 vehicles per day has three systems of roads. First is a 172-mile trunk system, second, a 250-mile feeder system and third, a 780-mile local system. For roads carrying less than 500 vehicles per day, where paving will be done in 2 or 3 years, stabilization is done immediately. This retains the surface material, controls dusting and reduces the ultimate cost of sub-base construction when the road is paved. Where paving is 3 to 5 years away, roads are reshaped and granular material added periodically to build up the surface in a stage construction process. Calcium chloride is added with each lift of material. Light stabilization of surface material is also practiced on roads scheduled for rebuilding as an interim holding measure. Calcium chloride has a definite place in any program where there is a need for density control, compactive-effort reduction and conservation of materials.

"How an Iowa County Builds Stabilized Bases and Surfaces." W. G. Harrington, County Engineer, Linn County, Cedar Rapids, Iowa. Better Roads, June, 1961.

Other Articles

"Tractor Seat Wired for Safety." The use of a circuit-breaking cable as a seat belt to stop the tractor engine if the operator is unseated. By R. W. Peacock, Equipment Superintendent, Ohio Turnpike, Berea, Ohio. PUBLIC WORKS, July, 1961.

"Aerial Study of Tunnel Approach Traffic Problems." Aerial strip photography records valuable data on traffic speeds and density. PUBLIC WORKS, July, 1961.

"State Highway Engineers Are Responsible for Developing New Ideas." To maintain reasonable prices for highway construction, new ideas must be developed to provide methods, de-

signs and specifications for more economical and efficient construction. By Walter F. Maxwell, W. F. Maxwell Co., Fontana, California. The Constructor, June, 1961.

"Memo on Public Information." Specific advice to field employees on the art of becoming a trustworthy source of news information. J. R. Bromley, Superintendent and Chief Engineer, Wyoming Highway Department, Better Roads, June, 1961.

"Landscape Development Policies for the Interstate Highway System." Utilization of natural and designed features provides a roadway which is functionally effective, aesthetically pleasing and economically maintained. PUBLIC WORKS, July, 1961.

"Baltimore Beltway Is Years Ahead of Old Schedule." Accelerated construction schedules will complete this facility years earlier than first planned. William F. Hallstead. PUBLIC WORKS, July, 1961.

"Earthwork Quantities By Computer." Factors in determining the accuracy of electronic computations. J. C. Barrett, Assistant Photronics Engineer, Mississippi State Highway Department, Jackson, Mississippi. Civil Engineering, June, 1961.

"Planning for Annual Highway Maintenance." George J. McCann, Assistant Supervising Engineer, and Ralph Stelljes, Engineer of Special Assignments, New Jersey State Highway Department. PUBLIC WORKS, July, 1961.

"Organization of a Traffic Engineering Department." Bernard L. Marsh, Village Manager, Skokie, Illinois. PUBLIC WORKS, July, 1961.

"Roadside Development on Ohio Interstate Routes." W. J. Garmhausen, Chief Landscape Architect, Ohio Department of Highways, Columbus, Ohio. PUBLIC WORKS, July, 1961.

"Soils Laboratory Assures Quality Control of County Road Building Materials." Bob Karolevitz. PUBLIC WORKS, July, 1961.

• • •

Relighting Program for Florence, Colo.

By the end of 1960, Florence, Colo., had installed 64 new mercury vapor street lights in its program for better lighting. Another 50 lights will be added during 1961. The program will permit a 50 percent reduction in the number of lights in some areas with an increase of 75 percent intensity of lighting. Annual lighting costs will be increased only slightly.

Body Sander for Snow Control

The addition of a body sander to the winter maintenance equipment of Manchester, Vt., according to the annual report for 1960, has permitted one man with a truck to do the work formerly requiring three trucks and six men.

PUBLIC WORKS for August, 1961

TESTS PROVE BANOX® PROTECTS against salt-slush corrosion



Laboratory and field tests show the need for Banox in salt used for snow and ice control to protect against corrosion damage by salt brine. Steel strips, such as the ones above, demonstrate what occurs to bare auto body steel on exposure to test solutions of de-icing salt, with and without Banox.

Rock salt is the effective and inexpensive way to control snow and ice on streets and highways. But salt-slush clings to bridges, ramps, salt-spreading equipment and, more important, motor vehicle underbodies, and the resultant corrosion damage adds up to many times the cost of protection with Banox.

Banox is easy to use — no special mixing is required. Effective in low concentrations, only one pound of Banox is needed for every one hundred pounds of salt. Banox costs so little—it averages only a few cents per capita per year.



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Now you can prove to yourself that Banox is effective. This desktop test kit contains everything you need for positive proof of Banox' protective action. A request on your official letterhead will put a test kit in the mail immediately.

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DIVISION: **HAGAN CHEMICALS & CONTROLS, INC.**

"The H-30 PAYLOADER® with Drott '4-in-1' bucket does not appear to have any limitations" says Wm. R. Elden, Director of Public Works, City of Elmhurst, Illinois



"It does everything Hough says it can do," continues Mr. Elden. "On snow removal it is fast and the four-wheel-drive provides adequate traction at all times. When working around residential property, private driveways and lawns, it does not damage stone curbs or driveway surfaces. It operates over snow-covered lawns and medians without tearing the surface, and is maneuverable in small areas."

Best by Test

"Before buying the H-30, we tried out three other loaders, but the H-30 impressed all with its versatility, including myself and the members of the City Council. The decision to purchase it was unanimous."

Easy to Operate

Operator Bruce Turleys says, "I've done just about everything with it including bulldozing, grading,

scraping and clamshell clean-up, clamshell dumping, stumping and tree-root removal.

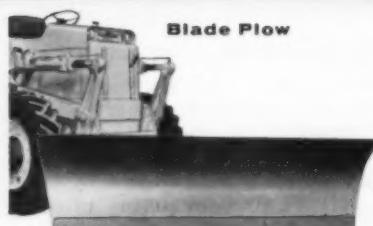
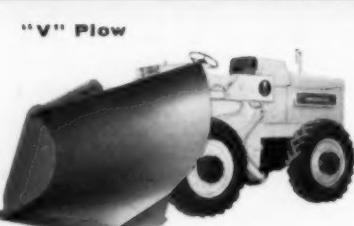
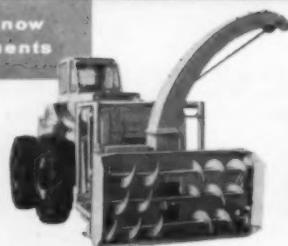
"The bucket selector gauge is absolutely accurate so I know the exact pitch of the bucket or cutting blade by merely glancing at it. I can make the machine do exactly what I want it to do.

"The visibility is excellent. Even with the cab doors closed there is no obstruction to block my vision of the job. The operating compartment is comfortable and all hand and foot controls are convenient and readily available. I can run it long hours without fatigue."

There is a proven PAYLOADER size to fit every need, and a variety of Allied Equipment to extend their usefulness to many specialized jobs. Your Hough Distributor is ready to show you how PAYLOADER versatility stretches the equipment dollars.



Other Snow Attachments





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Selling Your Traffic Program

John W. Gibbons, Director of Public Relations for the Automotive Safety Foundation, Washington, D. C. presented these remarks at the 1961 Illinois Traffic Engineering Conference.

THE MOST important single element in any effort to sell a traffic program—the true “first essential”—is not a public information technique at all; it is an attitude of mind on the part of the traffic administrator and his staff. He must accept personal responsibility for keeping the public informed fully of the problems of his office, the program designed to solve them and of progress or lack of it. This responsibility is a day-after-day thing; an integral part of major administrative decisions.

Public relations can not be effective if it is regarded merely as an appendage to the organization—a sort of “Mr. Fixit” to be called in now and then for emergencies. Former Prime Minister of Canada, MacKenzie King once said that “Government, in the last analysis, is organized public opinion.” I am firmly convinced that a traffic administrator with this concept of public relations will do a far better job of selling his program by personal contacts alone than will another man with an elaborate public information set-up—but with no real acceptance of responsibility at the top.

Public information has to start with personal contacts. In spite of the miracles of our electronic age which has given us radio and television, and in spite of today’s superb coverage of public affairs by newspapers and magazines, the top priority among all media for the traffic administrator is still old-fashioned personal contact, man to man. One reason is because sincerity and enthusiasm are highly contagious. Nothing is more convincing, nor helps more to inspire confidence in a man, an agency or a program, than to hear someone who obviously is sincere tell about what he is doing and why. If he is proud of his organization, that pride will show through, too. If he has difficult prob-

lems, his candor and sincerity will elicit sympathy.

Personal activities will, of course, be more productive if the contacts are made with opinion-forming people, that is, with civic, business and professional leaders who are in position to do the most about it. They will be more productive, too, if the program is presented not just in technical terms, but in terms of the benefits which the public will enjoy as result of the program. Traffic engineering is not an end in itself; its purpose is transportation service—this means convenience, safety and economy of movement. People are interested in those things. Every delegation is important, and all the other opportunities which the day-to-day job creates for person-to-person contacts. Every single conversation with a citizen registers either plus or minus on the final score.

I have been speaking about something which you yourself can do, as the engineer in charge of traffic. Needless to say, other members of your organization are going to catch your contagious enthusiasm; they, too, will become emissaries. And this applies all the way down the line. The fellow who paints the crosswalk or installs a sign is a roving ambassador of either good will or bad. If he knows your attitude on the importance of good relations with the public, and if he has had an opportunity to be infected with some of your pride and enthusiasm, he can be a highly important factor in the selling program.

Communication Media

Half the battle can be won through personal contacts. After that comes other extension of this effort to more people through the channels of communication in your city, county or in the state. This is the area which usually is thought of as public information, because it is that part of the job where specific techniques are required to get maximum results.

Numerous media are available. Weekly and daily newspapers, radio,

television, association bulletins, magazines, business and industry publications, motion pictures, slide films, posters, demonstrations, exhibits, advertising—the list is long and opportunities are legion. However, each of the media has special requirements of its own, as to type of material and format. The information about your program should be selected and prepared in a manner which will encourage its use. This means you will need the services of someone with background and experience in the public information field.

Sometimes you can recruit the help of public information personnel from outside organizations having an interest in the success of your program, such as motor clubs, chambers of commerce, safety councils and so forth. A part-time helper can make a great deal of difference.

The likelihood is that the weekly or daily press is the medium with which you have most frequent contacts. I suppose, too, that in some cases it is the one which gives you the most headaches. Relationships between newspapers and traffic engineers range all the way from wholehearted and successful cooperation down to open warfare. Invariably, as we discuss public relations, someone asks what can be done when a newspaper “takes out” after the traffic engineering program.

There isn’t any pat answer to that question but perhaps a few general observations would be in order. First, it is wise to distinguish, if possible, between the editorial policy of a newspaper and the man who calls on you for news. Try to maintain cordial and frank relations with the reporter who calls on you. It is not at all unusual for a newspaper to publish on one page constructive news of your activity, while in the same issue it is lambasting your program on its editorial page.

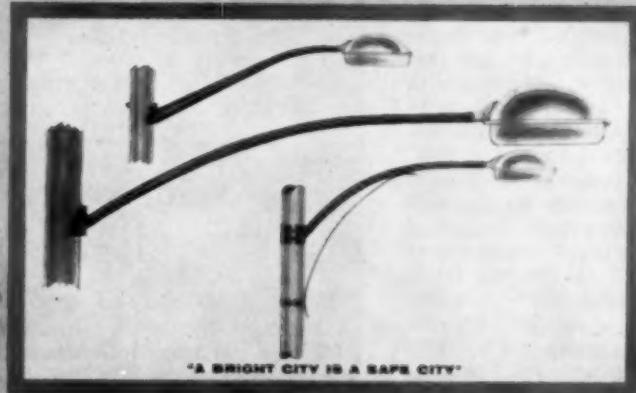
Second, keep the paper informed, just as if you liked the editor. This may be something of a challenge when your pet project is held up to ridicule by what you consider an ignorant and prejudiced layman, but it’s worth doing. The force of facts quite often can overcome the bias of hearsay. Third, and here I will repeat myself, keep making those personal contacts. Indeed, this is more important than ever if you are not getting what you consider to be a “fair shake” in the columns of a newspaper.

Fortunately, such relations are not the rule; they are the exception. Newspapers generally are in-

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terested in traffic news, because people are interested in traffic. In addition most editors and publishers are anxious to contribute to the common welfare in every way they can. Your traffic program has high priority among all the social and economic problems of the community.

Television is an ideal medium for traffic news because you can picture a situation on a screen with greater clarity than you can with words. Broadcasters and traffic administrators are cooperating usefully in many communities. Flannel boards, diagrammatic panels with street layouts and toy vehicles, and similar devices make it possible to translate fairly complicated traffic engineering information into readily understandable viewing.

Radio as you know is a booming industry. From the standpoint of traffic, this medium has an advantage, too; it is beamed directly into vehicles where drivers and pedestrians can hear it. Sort of a "point of sale" message, as it were.

Radio and television stations alike are carrying a great deal of traffic material these days; weather information, safety messages, warnings on road detours and so on. This is the kind of public service they like

because it is information in which nearly everybody is greatly interested. Many of these shows are regularly scheduled. When you have something of particular interest in the traffic engineering field, it's a simple matter to learn the name of the producer of one of those shows, get in touch with him and offer your information and help.

In concluding, however, I want to go back to my first statement, because it is the most important

view I can offer. A recognition by the top administrator of his personal responsibility for public information is the key to selling the traffic program. Everything worthwhile must begin there; everything else flows from that first essential step. Government is, in the final analysis, organized public opinion, and part of the day-to-day duty of the public officer is to supply the facts on which that opinion must be based.

Ditch Construction Method Combines Speed and Economy

SPECIALIZED methods of ditch construction used on a highway project in the rugged Cumberland Mountains of Tennessee has been reported by the National Bituminous Concrete Association. Three different types of asphalt ditches totaling 34,898 lineal feet (6.6 miles) were paved, using 6,631 tons of asphalt binder mix. For this work the Knoxville Construction Co. utilized equipment adapted to the particular problems involved.

Side ditches. A Caterpillar No. 12 grader with templet bolted to the

mo. board was used to shape the ditches and to spread a 1-in. stone insulation course. The asphalt mixture was then spread by a No. 95 Blaw Knox widening spreader operating off of the 12-ft. pre-mix shoulders with a templet shaped to the contour of the ditch and bolted to the strike-off plate with adjusting screws. The belt conveyor and strike-off assembly had to be extended three feet to get the required 6-ft. side ditch design specified in the job. To compact the side ditches, a 6-ft. metal roller weighing

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At the Columbus Municipal Airport, Columbus, Ohio, dependable Gledhill Snow Plows work 24 hours a day to make runways safe for landings and takeoffs by today's fast airliners.

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This R-V-L Plow, used at the Columbus Airport, is only one of a complete line of Gledhill snow and ice removal equipment. Other types of snow plows include "V" Plows with Wings, Straight Plows and Taper Plows — plus custom designs and sizes.

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PUBLIC WORKS for August, 1961



• COMPACTION of the asphalt mix on the side ditches was accomplished with this specially designed 6-foot metal roller attached to the bucket of a Cat D-4 loader.

1200 pounds was attached to a 6-in. I-beam eight feet long and bolted to the bottom of a Caterpillar D-4 loader bucket. An adjustable bracket from the I-beam to the roller yoke was used to equalize weight to the roller. A 55-gallon oil drum

placed in the bucket was connected to a sprinkling system along the roller yoke.

Median ditches. An 18-ton tandem dump truck was used to dump into a 4-wheel, 10-foot spreader box with concave strike-off to fit the

ditch design. The spreader box was pulled by the truck by chains fastened to the dump bed. This design was also used to lift the spreader over catch basins and to move the machinery without dismantling. A 1-in. stone insulation course was spread on a prepared grade with a 10-ft. concave templet bolted to the grader moldboard. In rolling the median ditches, a 10-ft. steel roller, cut and welded to a drum-shape design to meet the specified contour and weighing 2000 pounds (with additional weight to be added by filling the drum with water), was attached to the front of an I-9 International tractor by a yoke bolted in place of the pony-wheel. Special axles were made of sufficient length to keep traction wheels off the 10-ft. spread of mixture during the operation, which required three passes to compact and seal the surface of the median ditch pavements.

Special ditches. These were run off ditches in inaccessible locations and fortunately, the engineers state, there were not many to be constructed. They were 10 to 12-ft. wide with flat bottoms which could be rolled by a small power roller. A small hand roller was used for rolling the sides.

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Maximum Cleansing Effectiveness Plus Positive Precaution Against Skin Irritation



Helping squelch trouble before it begins, new Go-Jo Liquid Protective Skin Coat creates an invisible, greaseless barrier that prevents dirt and irritants from entering the pores. Liquid Protective Skin Coat does not impair sensitivity as do gloves and will not affect materials handled.



It's best to wash as often as grease and grime accumulate. (Prior application of Skin Coat facilitates clean-up.) Go-Jo Creme Hand Cleaner contains antiseptic GT-7 to help prevent irritation, and may be used without water for the frequent on-the-spot clean-ups.



Because its emollient ingredients replace natural skin oils and soothe tiny nicks and scrapes, it aids in keeping the hands in good condition for the next day's work.



The Go-Jo Heavy Duty Dispenser cuts handcleaning costs up to 75% by delivering the right amount of Go-Jo Creme Hand Cleaner for a quick, thorough clean-up. Precision engineering eliminates waste.

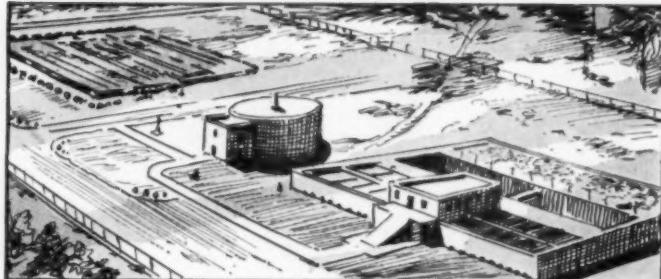
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THE
SEWERAGE
AND
REFUSE
DIGEST



Prepared by ALVIN R. JACOBSON, Ph.D.

Associate Professor and Head, Division of Sanitary Science, Columbia University School of Public Health

DO and BOD Determinations

The Dissolved Oxygen (DO) and Biochemical Oxygen Demand (BOD) measurements have assumed a position of utmost importance in waste treatment and water pollution control. The standard tests for DO and BOD (Standard Methods) have many shortcomings and disadvantages which have not been overcome fully from a practical standpoint. The authors have carried on an investigation to develop a working polarographic system for continuous dissolved oxygen. From the experimental work on the application of a plastic covered stationary electrode system for DO and BOD determinations, the following conclusions were reached: 1) The electrode gives reproducibility of dissolved oxygen measurements comparable to that of the standard chemical (Winkler) tests; 2) the electrode system response is temperature-dependent; since all BOD work is carried out at a constant temperature, temperature compensation is not required; 3) the electrode cell will operate satisfactorily with either potassium hydroxide or potassium chloride, in varying concentrations, as an internal electrolyte; 4) zero-drift of the electrode cell is caused primarily by changes in the battery; replacing the battery every 10 to 15 days will eliminate this effect; 5) the polyethylene film is satisfactory as an electrode membrane, and is seldom a cause for electrode cell errors; 6) in general, a thorough rinsing of the electrode in distilled water at the end of each 5-day BOD test is sufficient for routine BOD work; 7) with proper control of operating conditions, continuous BOD analysis of domestic sewage can be made with the plastic covered, stationary platinum-electrode system.

"New Platinum Electrode System Measures DO and BOD." By J. D. Eye, L. H. Reuter, and K. Kesavan, respectively, Assoc. Prof., Sanitary Engr., University of Cincinnati; Lieut., U. S. Army; Graduate of Cincinnati Water & Sewage Student, Sanitary Engr., University Works, June, 1961.

Sludge Disposal

The Alexandria Sanitation Authority operates an 18-mgd, high-rate, single-stage filtration treatment plant which serves all but a small section of the city of Alexandria plus an adjacent area in Fairfax County, Virginia. Principal components of the plant include lift pumping; mechanical screening and

grit removal; primary settling; trickling filtration; final settling; two-stage sludge digestion; and mechanical sludge dewatering. The sludge disposal facilities include elutriation, chemical conditioning, and vacuum filtration. Sludge cake is stockpiled on the plant property and is available to the public at no charge for use as a soil conditioner. In the 1958-59 fiscal year a total of 4,015 tons of wet sludge cake were produced which represents an average yield of 6.8 lb. of dry solids per sq. ft. of filter area per hour. Average chemical feed rates were 2.9 percent ferric chloride and 7.5 percent lime, as calcium oxide, on a dry basis. The elutriation wash water to sludge ratio was maintained at approximately 3 to 1. Total op-

CHICAGO USES FLUORESCENT COLOR FOR LITTER BASKETS AND VEHICLES

BECAUSE fluorescent colors are brighter than conventional paints, Chicago, Ill., decided to spray-paint litter baskets, of expanded metal, with Velva-Glo fluorescent finishes. Colors used were pink, orange-red



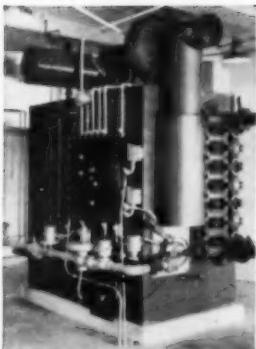
● BRIGHT color for litter baskets.

and chartreuse. Cliff Cohen, maintenance engineer for the Francis Cabrini Project of the Chicago Housing Authority, estimates the volume of paper placed in the 48 fluorescent colored baskets in his project increased 100 percent over that previously left in conventionally colored baskets. Mr. Cohen also estimates that fluorescent-colored baskets save 50 percent of the manual labor required to police and pick up paper in the area served by these litter baskets.

Chicago also painted some vehicles of the Sanitary and Traffic Control departments with fluorescent colors. Accidents are reported to have been reduced at 50 percent among vehicles so painted, with most notable reductions in vehicles used for snow removal and traffic surveys.

P.F.T.'s rugged equipment

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P.F.T.'s #750 Heater
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Mt. Airy, N.C. is located at the foot of the beautiful Blue Ridge mountains and is the home of the world's largest open-faced granite quarry. Such structures of national prominence as the Arlington Memorial Bridge in Washington, D.C. and the Gold Bullion Depository at Fort Knox have been built of Mt. Airy granite.

As rugged and durable as Mt. Airy granite is the P.F.T. waste treatment equipment at this plant. The citizens of Mt. Airy are proud of their plant's modern architectural design and the contribution it plays in water pollution control.

P.F.T. equipment includes one #750 Heater and Heat Exchanger unit, two 65' Floating Covers, Supernatant Selector and Gauge and Gas Safety equipment.

Consulting engineers—*The J. N. Pease Co., Charlotte, N.C.*



ABOVE: Two 65' P.F.T. Floating Covers.

RIGHT: Modern architecture—efficient operation with P.F.T. equipment at Mt. Airy's new plant.



waste treatment equipment exclusively since 1893
PACIFIC FLUSH TANK CO.

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erating costs averaged \$16.38 per dry ton of solids, not including general administrative costs.

"Sludge Disposal at Alexandria." By Samuel W. Shafer, Engineer-Director, Alexandria, Va. Sanitary Authority. *Journal WPCF*, June, 1961.

Studies On Oxygen Demand

This investigation was carried on in the laboratory at the Back River sewage treatment works to obtain information on the part *E. coli* plays in the stabilization of organic mat-

ter in sewage and in accounting for the BOD. A sample of raw sewage was disintegrated in a Waring blender and divided into two parts. One part was sterilized by autoclaving it, and the other part was not autoclaved. The coliform bacteria counts were determined on the unautoclaved part. This sewage was thoroughly mixed and then divided into 8 portions. At the end of 1, 2, 3, 4, 5, 10, 15 and 20 days, BOD, pH and other tests were made. The autoclaved sewage was tested for sterility, divided into 3 portions, each portion inoculated with a dif-

ferent amount of *E. coli* concentrated culture. At the end of 1, 2, 3, 4, 5, 10, 15 and 20 days the BOD, pH and *E. coli* were determined. The 20-day BOD of the unautoclaved sewage was about 28 percent higher than the BOD of the autoclaved sewage inoculated with *E. coli*. The greater BOD was undoubtedly due to the presence of organisms in the unautoclaved sewage that were capable of oxidizing organic matter which the *E. coli* in the autoclaved sewage could not attack.

"Studies On Oxygen Demand Of Sterile Sewage." By C. E. Keefer, Sewerage Engineer, Bureau of Sewers, Baltimore, Maryland. *PUBLIC WORKS*, July, 1961.

Incineration and Sewage Treatment

Whitemarsh, Pa., a suburb of Philadelphia, placed in operation in 1959 the first incinerator employing the horizontal flow-through principle. It is located next to the sewage treatment plant and is so designed that the two facilities are complementary. Excess heat developed from refuse combustion makes it possible to burn raw sludge from the treatment plant at high temperatures, while effluent water is used for cooling the incinerator furnace walls and for scrubbing the incinerator stack gases. Undigested sludge is pumped from the holding tank to vacuum filters in the incinerator building where it is dewatered. The sewage and refuse are mixed before burning. Several plant details and arrangements have required modifications to suit practical operating conditions or to simplify maintenance.

"Incinerator and Sewage Treatment Plant Work Together." By B. B. Reilly, Chief Development Engineer, Dravo Corp., Pittsburgh, Pa. *PUBLIC WORKS*, July, 1961.

Stabilization Ponds for Raw Sewage

Due to a dearth of information on basic principles of operation of stabilization ponds, the Public Health Service in 1956 entered into an agreement with the Missouri Division of Health and the city of Fayette, Mo., for construction and controlled operation of stabilization ponds using Fayette sewage. The initial objectives were determination of the following: 1) Performance as judged by effluent quality and possible nuisance development; 2) efficiency as related to loading rate and climatological variation; 3)

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SEWAGE PUMPS

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SUBMERSIBLE NON-CLOG A complete unit ready to install includes pump, motor, automatic controls and cable to control panel. Send for Bulletin 1850.5.

Outstanding performance and long trouble-free service from every type. Pacific Non-Clog Sewage Pumps combine all desirable design features that assure efficient, economical and dependable operation and service.

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Smith & Loveless Sewage Pump Stations are factory built "with the maintenance man in mind." Every detail is designed to make his job easier, faster, safer. To us, he is just as important as the engineer who specifies the station, the contractor who installs it and the buyer who pays for it.

His Smith & Loveless station comes complete with understandable maintenance and operating instructions, full color-coded wiring in the control panel, easy-to-reach starters and breaker switches, all fully identified for his safety and convenience—a dependable, patented ventilating system and humidity control, ample "elbow room" so he can work efficiently. From the minute he opens the cover on his first trip to the station, he knows the whole unit was designed with him in mind—for instance, the cover rungs that extend the ladder for his safe entry, and when he lifts the cover, the lights and ventilating blower turn on, automatically.

Perhaps he even "rides to work" in the pump room below, on an elevator—and inside (on the '61 models) there's even an ashtray and wastebasket for his convenience.

When inevitable wear makes it necessary to replace the dead-tight mechanical seal in that smooth-running Smith & Loveless pump, he knows it won't take long—just 30 minutes or less—a far cry from old-fashioned pump packing and seal maintenance on other pumps on the market. And, what better way to keep noxious gases, odors and sewage out of the pump room?

*For the complete story on Smith & Loveless factory-built sewage lift stations
—write to Department 40.*

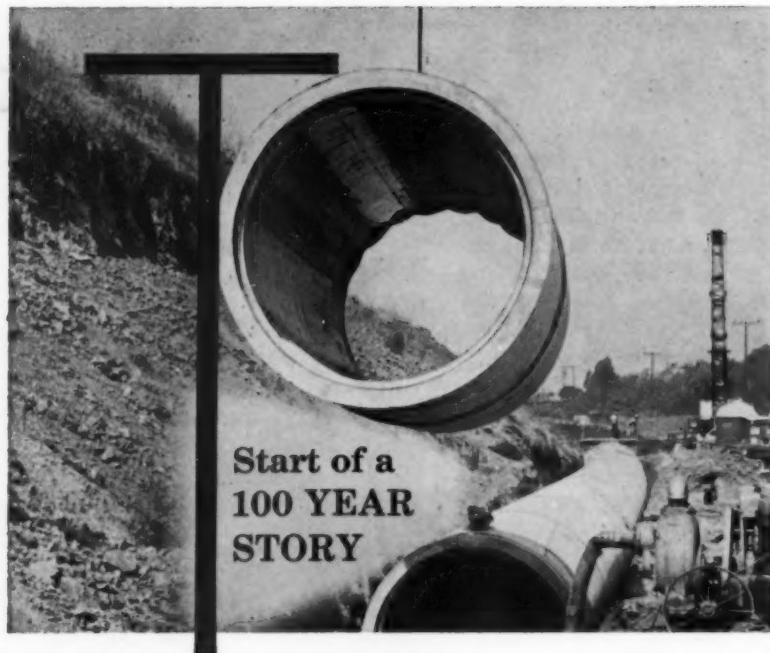
Smith & Loveless

DON'T JUST
ASK THE MAN WHO
OWNS ONE—ASK
THE MAN WHO
MAINTAINS ONE



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This reinforced concrete sewer will be in service generations from now, because concrete surpasses all other materials. Most concrete sewers do not require protection, but when strong chemical effluents or oxidized H₂S are a problem, only T-LOCK AMER-PLATE provides positive protection. T-LOCK AMER-PLATE is a high molecular weight polyvinyl chloride sheet which is cast into the concrete while in the process of manufacture.

T-Lock Amer-Plate meets all the requirements of the ideal sewer lining:

- T-Lock is extremely dense and impervious. Permanently protects concrete from chemical effluents and H₂S corrosion.
- T-Lock is permanently flexible. Tensile strength minimum is 2200 psi; elongation at break is a minimum 200%.
- It is mechanically bonded to the pipe. Pull tests result in the breakage of concrete before T-Lock fails.
- T-Lock withstands 40 psi back pressure, equal to a ground water head of 85 feet.
- T-Lock has a smooth, highly abrasion resistant surface... maintains its N factor of .010 indefinitely.

There are no other materials — paints or troweled-on mastics, mortars, sacrificial aggregates or admixes — which meet these vital requirements.

Where protection is required, only T-LOCK will do the job. Compromise methods are a gamble which experienced sewer designers will not take; they know it is money wasted to specify linings which will fail within a few years.

Because T-LOCK AMER-PLATE is the only completely satisfactory material on the market today, millions of square feet are now in use in cities throughout the nation.

For a complete list of users and specifiers, plus technical data, write:



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360 Carnegie Ave.
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6530 Supply Row
Houston, Tex.

the most favorable loading (pounds BOD/day/acre) for this location. There are five small ponds, each 1 acre in area when filled to a depth of 5 ft., and $\frac{3}{4}$ acre each when liquid is $2\frac{1}{2}$ ft. deep. A large pond is 15 acres in area at its usual operating depth of 3 ft. It receives effluent from the small ponds and the raw sewage not used in their loadings. Based on quality of final effluent from Cell 6 (the 15-acre pond), performance of the entire facility was outstanding. All individual units were equally efficient until ice cover reduced photosynthesis. Performance of the units with daily BOD loadings of 60 to 100 lb. acre suffered decline. The 15-acre unit acted as a secondary in-series unit in many respects and increased oxygen production when other units entered the winter decline. Removal of BOD averaged more than 80 percent in all units while all cells had average coliform-type bacteria removals in excess of 99.99 percent.

"Experimental Lagooning of Raw Sewage at Fayette, Missouri." *Journal WPCF*, June, 1961.

Westchester County's Plant

In order that Westchester County could comply with the standards established by the Interstate Sanitation Commission, to control the water quality along the shores of New York, New Jersey, and Connecticut, it was necessary for the County to improve its treatment of sewage before discharge to Long Island Sound and to the Hudson River. Consulting engineers recommended: 1) A single sewage treatment plant to be located on a site consisting of land to be reclaimed by filling operations behind a stone dike to be constructed in the Hudson River opposite the existing South Yonkers treatment plant; 2) this plant should provide for grit removal; 30-minute aeration of sewage with a small proportion of returned sludge; two-hour sedimentation and chlorination of the effluent before discharge into deep water; 3) provisions should be made for sludge thickening and disposal at sea by means of a barge. Sewage would be brought to the new plant by gravity through a 78-inch connecting sewer from the existing South Yonkers plant, and through a 54-inch force main from the existing North Yonkers plant which would be converted into a pumping station. The various problems encountered during construction and start-up of the treatment

WHY "STIR UP A STORM"

when you want uniform, rapid sludge removal

REX UNITUBE TOW-BRO provides positive, uniform, gentle and rapid sludge removal...with highest possible sludge concentration...without a storm.

Because it employs a *gentle suction action only* instead of the conventional plowing or combination plowing and suction action to withdraw sludge, Tow-Bro reduces agitation of the sludge to the absolute minimum. Results: higher solids concentrations...clearer effluent...less volume...most rapid withdrawal rates and maximum possible range of any mechanism. In addition, since sludge is withdrawn at a faster rate...even with a light sludge blanket...you get greater settling tank capacity and greater operating flexibility. Construction costs are less, too, because no sludge hoppers or center pier is required and tank bottoms are essentially flat.

With Unitube Tow-Bro, a tapered, rectangular header arm revolves slowly around the tank and removes all sludge from the tank bottom in one revolution. Sludge is withdrawn through scientifically spaced and sized orifices in the arm by a gentle suction. Operating costs are reduced since minimum pumping is required to handle sludges of maximum density over the full operating range of withdrawals.

If you're looking for greater capacity...if you're having problems handling activated or trickling filter sludges, or other tricky sludges...investigate Rex Unitube Tow-Bro. For complete facts, send for your copy of Bulletin 315-81. Write CHAIN Belt Company, 4722 W. Greenfield Ave., Milwaukee 1, Wis.



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CHAIN BELT COMPANY

plant are discussed in this article. A \$15 million bond issue was approved by the voters for this project.

"Westchester County Dedicates Yonkers Joint Primary Plant." By Guy E. Griffin, Deputy Commissioner of Public Works and James M. Brown, Superintendent, Sewage Treatment, Westchester County Department of Public Works. *Wastes Engineering*, June, 1961.

Other Articles

"Synthetic Detergents in Ground Water." Part II. concludes this report of

syndet pollution of Eastern U. S. ground waters. By Louis G. Campenni, FHA Zone Engineer, Bayside, L. I., New York. *Water & Sewage Works*, June, 1961.

"Instrumentation in Water Pollution Control." A discussion of the problems confronting continuous analytical instrumentation in monitoring stream pollution. By Robert H. Jones, Application Engineer, Beckman Instruments, Inc., Fullerton, California. *Water & Sewage Works*, June, 1961.

"Culture and Harvest of Attached Algae" grown on domestic sewage. Part I. Discussed here are some considerations involved in the use of attached algae to improve wastewater

plant effluents and their possibilities as a food source. Part 2, to be presented later, will describe laboratory studies and pilot plant operations. By George W. Reid, Prof. of Sanitary Engr., and Joseph R. Assenzo, Asst. Prof. of Sanitary Engr., University of Oklahoma, Norman, Oklahoma. *Water & Sewage Works*, June, 1961.

"Explosion and Fire Wreck Sewage Plant Screen House." Motors may have ignited volatile gas fumes. By Robert J. Burdick, Principal Engineer (Sanitary), Jersey City Water Works, Boonton, N. J. *Wastes Engineering*, June, 1961.

"Designing Biological Oxidation for Industrial Wastes." Part 2. Investigating the role of oxygen and nutrient factors in determining the capacity of biological processes. By W. Wesley Eckenfelder, Jr., Assoc. Prof. of Civil Engineering, Manhattan College. *Wastes Engineering*, June, 1961.

"Force Account Construction and Direct Purchases by Water and Sewerage Utilities." Direct purchases represent an impressive and uniform market potential. By Walter L. Picton, Director, Water and Sewerage Industry and Utilities Division, Business and Defense Services Administration, Department of Commerce, Public Works, July, 1961.

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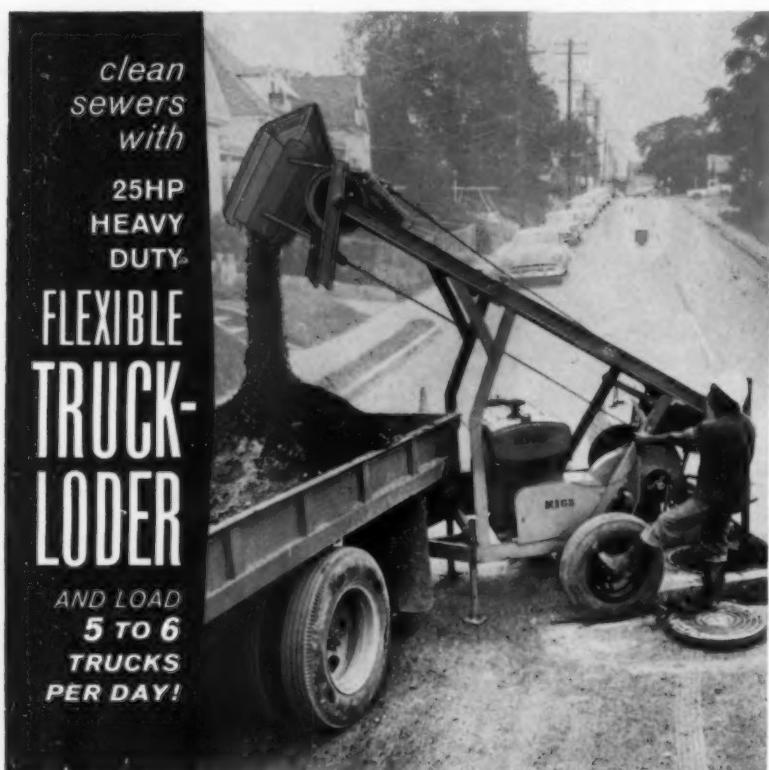
A man experienced in sanitary engineering sales and sales supervision is available. Wide acquaintance with consulting and other engineers. Now located in the East and generally prefers Eastern location, but will move. Full details of experience and training and references from Box 8M, Public Works Magazine, 200 South Broad St., Ridgewood, N. J.

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A highly qualified public works and sanitary engineer is available in the south Florida area as representative and/or manager for a consulting engineer desiring to open an office in this area. Considerable experience in design and in management; well known. Address Box 8F, c/o Public Works, 200 South Broad St., Ridgewood, N. J.

Ohio Recreation Association

The Ohio Recreation Association will hold its annual meeting Nov. 8-10 at the Biltmore Hotel, Dayton. O. Gordon J. Guetzlaff, Bureau of Recreation, Municipal Bldg., Dayton, is Conference Chairman.



Sewer to Truck NON-STOP—no complicated auxiliary dumping devices

For the big job, in sewers 24" and up, the Heavy Duty Model Truck-Loder gets the job done FAST by using a 5.4 cu. ft. bucket. Special wide flange rollers to handle the big bucket; heavy duty framing; and the 25 h.p. Wisconsin air cooled engine, make short work of a tough job. Many cities report removing 5 to 6 truck loads of sewer muck in one day.

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REDUCING WATER POLLUTION BY SHIPS AND PLEASURE BOATS

UNDER THE Interstate Quarantine Regulations, the Public Health Service has designated areas around domestic water intakes in the Great Lakes in which the discharge of sewage and wastes from vessels is prohibited. In general these areas are defined as a circle of 3 miles radius with the water intake as the center. The several State Health Departments have cooperated with the Public Health Service in establishing these areas.

Personnel has been assigned by the Division of Engineering services to Region V, Chicago, to conduct a study project relating to vessel operations on the Great Lakes. This project will include studies on: 1) protection of vessel water supplies; 2) discharges of wastes from vessels; 3) delimiting areas around water intakes; 4) discharges of garbage; 5) port sanitation; and 6) harbor sanitation.

Further, an inter-agency committee on sewage and waste disposal from vessels has been established with representation from the Maritime Administration, the Corps of Engineers, the Navy Bureau of Medicine and Surgery, Navy Bureau of Ships, the Surgeon General of the Army, the Coast Guard, Department of Agriculture and the Division of Foreign Quarantine, Water Supply and Pollution Control and Engineering Services of the Public Health Service. The major objective of this committee will be to establish criteria for the disposal of sewage and waste from vessels operating in the Great Lakes, and the inland and coastal waters of the United States.

Treatment

In the March issue of PUBLIC WORKS, E. J. Cleary discussed the progress being made on the control of sewage pollution by pleasure boating interests. As stated in that article, New Hampshire has adopted regulations governing marine toilet effluents. These are required to: 1) be free of unsightly solids; and 2) to contain a most probable number of coliform bacteria not exceeding 240 per 100 ml.

The American Boat and Yacht Council has adopted standards which provide that a space at least 24 by 14 by 17 inches be allotted on all new boats to accommodate the installation of treatment devices.

At least four firms appear to be producing units designed for boat or vessel sewage treatment. The Wilcox-Crittenden Division of the North & Quad Mfg. Co. furnish a chlorinator unit using any household bleach or disinfectant that contains as much as 5 percent sodium hypochlorite by weight. This is connected into the discharge line between the toilet and through-

hull outlet. It is claimed to pulverize quickly all human waste solids and to destroy 99.96 percent of all bacteria present. Bacteriological tests made at Wesleyan University indicated that the New Hampshire requirements would be met. Other tests showed that all solids readily passed 1/16-inch openings; that the chlorine concentrations ranged from 10 to 70 mg/L and BOD values from 500 to 2280 mg/L, averaging 1070, and probably representing a reduction of about 50 percent.

Larger units, designed for 30 and for 60 men are produced by Youngstown Welding & Engineering Co.

Roll-call for water



Indians Say: "Ugh! Too Many White Man!"

In 1814, when Jackson defeated the Creek warriors at Horseshoe Bend, Ala., it probably never had occurred to anyone that someday there would be so many people in the east-south-central States that there could be a shortage of water!

But that Indian defeat was the beginning of a new era. It set the stage for settlement of the Deep South by white people. Immigrants poured into the section, started growing cotton, then corn, then livestock. Later they discovered coal, iron ore and other minerals until sections of this country today support a great industrial economy.

It would have been hard for Andrew Jackson to believe that there ever would be 29 public water systems in this Deep South country, each supplying 25,000 or more population; but that 5 (16%) of the 29 water systems would be of doubtful efficiency and 4 (13.7%) of them would be definitely deficient. Yet, this section of the U.S. is in better shape than the country as a whole where the definite water system deficiency runs 26.6% and the doubtful efficiency totals 23.2%.

Kentucky
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Alabama
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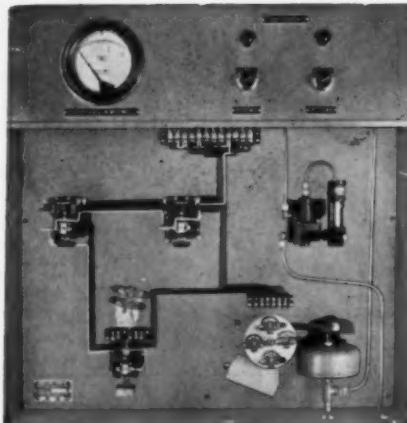


PRESSURE-OPERATED SUMP CONTROL

The RPS Rototrol is a pressure-operated sump control for starting and stopping pumps discharging out of a wet well. It is practical and dependable for either raw sewage or clear water—wherever accurate control of level is required.

The RPS is unaffected by changes in conductivity or build up in sludge. Has no moving parts in the wet well. Can be located anywhere. Requires only pressure connection between control and wet well. Operates from plant air or separate air compressor.

For full details, write for Bulletin RPS.



FLOAT CONTROLS — Healy-Ruff also makes a complete line of float-operated controls. Rototrol 940 permits each pump, up to 10, to have several starting and stopping positions. RF2 controls up to 8 pumps in sequence. Type 151 provides single pump control. Automatic alternator or transfer plugs available optionally.

Write for descriptive literature.

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First in dependable controls for waterworks and sewage—since 1929

Remote supervisory controls • Complete system controls • Elevated tank controls • Sump controls • Hydropneumatic tank controls • Float controls • Alternators • Alarm Silencers • Protective devices

6123

Are your buildings flying **DISTRESS SIGNALS?**

Call Western Waterproofing for prompt action to

REPAIR WEATHER DAMAGE

PREVENT FUTURE TROUBLE

Look for these signs of weather decay:

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- Crumbling Mortar • Disintegrating Concrete

Property owners lose millions of dollars each year from the slow, steady deterioration of their buildings under constant exposure to rain, wind, snow, frost and other elements. At first, weather damage may be slight, but progresses rapidly, and if not checked, can lead to serious trouble and costly repair bills.

If there's ever a place to exercise an "ounce of prevention", it's in the care of your buildings. Call Western Waterproofing in St. Louis for expert, professional

TUCKPOINTING • CONCRETE RESTORATION • BUILDING CLEANING • SUB-SURFACE WATER PROTECTION



A number of these are now in service on ships plying the Great Lakes. Treatment consists of pulv-erization and chlorination. The raw sewage is piped to a receiving tank which is equipped with an agitator and a liquid level control. When the level in the tank reaches a predetermined point, agitation begins. After a preset time, a pump, grinder and hypochlorite feeder are started. An "incubation" tank holds the sewage for a period of "bacteriological neutralization." A minimum period of 30 minutes between pumping cycles is provided. A by-pass line permits direct discharge of wastes in unrestricted waters.

The 30-man unit is 9 by 3½ by 5 feet and weighs 4700 lbs. The 60-man unit is 11 by 5 by 7 feet and weighs 5400 lbs. Either unit operates on fresh or on salt water. An aerobic digester can be added to either unit, according to the manufacturer, but no details on this are available.

Other manufacturers of similar equipment include American Shipbuilding and Light Industries, a Canadian organization. No data are available on their products.

• • •

Accounting for Sewerage Systems and Treatment Plants

Because of the increasing trend toward the utilization of other than municipal funds for the construction of sewerage systems and treatment plants, the problem of proper accounting for these facilities becomes important. Accordingly the Editors have attempted to obtain information on proper methods of keeping these financial records with special attention to depreciation factors. Such data are difficult to obtain. Some information is presented herewith and more or less comprehensive articles are in preparation.

The Lompoc, Calif., Light and Water Department, Emil Scolari, Manager, has furnished the following depreciation figures: Sewage collection system 2 percent per year; treatment plant 5 percent; tools 20 percent; furniture and fixtures 10 percent; automobiles 20 percent; and work equipment 10 percent. Mr. Scolari states further: "Depreciation of the systems should be geared to the economy of the area it serves. Master planning of trunk sewers and plants should be given very careful consideration in order to avoid the necessity for replacements before the expected life is reached. The depreciation accounts should be reviewed periodi-

CAT NATURAL GAS ENGINES— POWER AT MINIMUM COST FOR...

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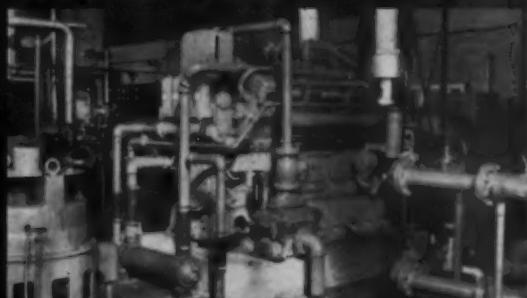
BY CATERPILLAR

• Standby Electrical Power



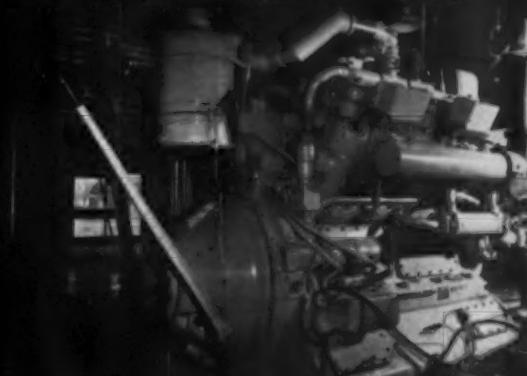
Commercial power failures are no longer a threat to a hospital in Tulsa. A Cat V-12 Natural Gas Electric Set stands by to protect patients against a sudden power outage.

• Disposal Plants



This Caterpillar V-12 Natural Gas Engine and a smaller Cat G342 are providing power for aeration blowers at a central Illinois sewage disposal plant. They are burning otherwise wasted 570 BTU/cu. ft. LHV sewage gas. Their monthly records indicate the fuel consumption average to be 7000 BTU/BHP-HR.

• Municipal Water Pumping



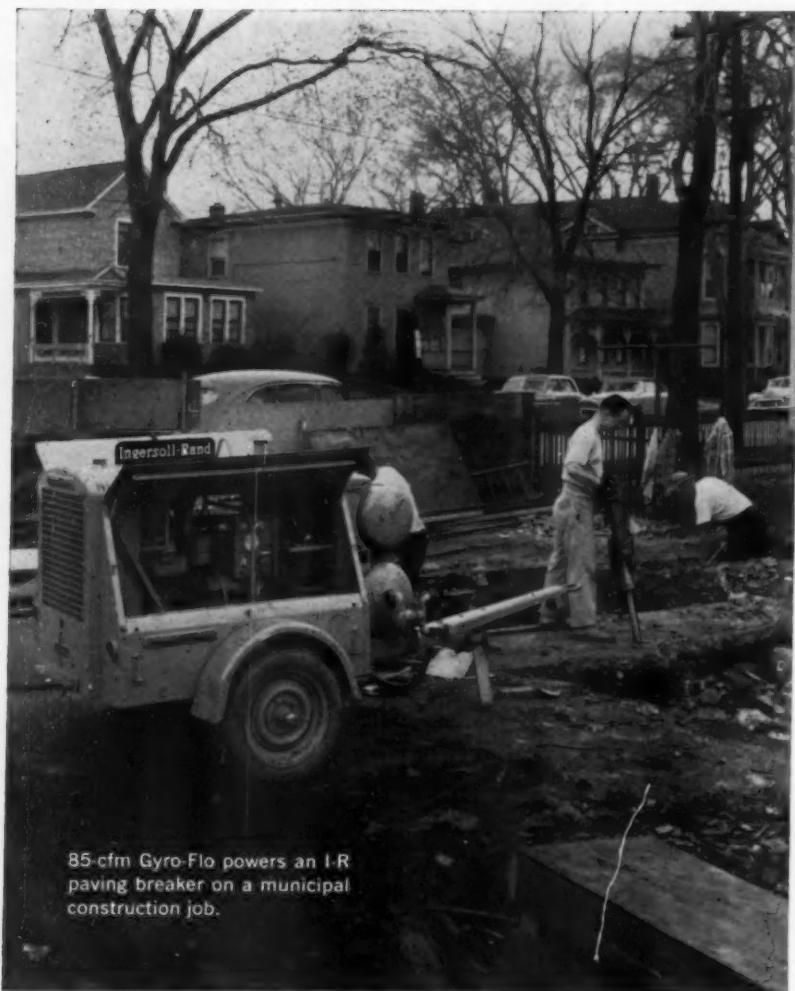
Running 24 hours per day, 7 days a week, this Cat Natural Gas Engine furnishes power for water pumping at a 3000-home development near Chicago.

Cat Natural Gas Engines lower costs for air conditioning, standby power, pumping, gas separation plants and many other applications. Caterpillar engines use up to 26% less fuel than other natural gas engines in their power range. For more facts, see your Caterpillar Dealer or your equipment supplier.

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Municipal maintenance costs
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DEPEND ON GYRO-FLO

Air power is an important cost for most municipal construction and maintenance work. Keep it *low* by depending on Ingersoll-Rand Gyro-Flo portable compressors for long-range savings in fuel, lube oil and up-keep costs. Their design is the result of 10 years of experience by the pioneer builder of portable rotary compressors.

Available in sizes from 85 to 900 cfm, Gyro-Flo portables are known the world over for outstanding dependability on any job, in any climate.

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cally to make sure they are equitable."

The account system used in Lompoc shows as assets, the cash on hand and accounts receivable; the value of the sewer system, including stores inventory, working equipment, the sewer system and additions to it; and the sewage treatment plant, including working equipment, the plant, furniture and fixtures, accumulated additions, small tools, buildings and structures and automobiles and trucks. Liabilities include accounts payable, customer deposits, sewer main extension deposits, general fund advances and contingent advances; reserves and surplus include provision for depreciation of the sewer system, for the working equipment, and for the various items of and at the sewage treatment plant. Also included are contributed system capital, surplus invested in the sewer system and in the treatment plant, current surplus and profit and loss.

Revenues include sewerage service fees, other revenues, sewer main extension charges and sewer connection charges. Expenses include the costs of supervision; accounting, billing and collecting; uncollectable bills and interest on service deposits. Also included are items covering the sewer system — operation, repairs and maintenance, social security charges, insurance, depreciation and light and power; and items covering the treatment plant from salaries, to property taxes segregated into 11 items.

Corwin S. Elwell, Town Manager, Town of Brattleboro, Vt., writes: "At the present time the Town of Brattleboro is maintaining main line sewers and manholes which are being depreciated at a rate of 2 percent per year. This percentage, I believe, was suggested by our auditors at the time the bookkeeping system for the sewer department was established. This would anticipate a useful life of this facility of approximately fifty years, which does seem to be reasonable.

"More complicated sewer systems, which contain pumping stations, sewage treatment plants, etc., would of course have to set up varying degrees of depreciations on various structures and mechanical equipment, depending upon the useful life of each unit involved. This is precisely the way we handle depreciation accounts in our Water Department, which has many units with varying percentages of depreciation depending upon the anticipated life of the equipment involved."

Before, during, and after installation... Transite never stops saving you money!



...ON WATER MAIN JOBS

Transite® speeds any water line installation. Its long lengths are easily and quickly handled. The Ring-Tite® joint means a tight seal at every coupling in the line! The result: a quality job at low cost!

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Transite speeds assembly, means a bigger day's return. And the J-M Ring-Tite joint is your assurance that the line will pass leakage or infiltration tests. You "button-up" the job faster when you use Transite Sewer Pipe.

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Transite Underdrain Pipe means savings wherever subsoils must be stabilized. This new perforated pipe means savings to contractors, for Transite's long lengths, fewer joints, low material cost all add up to more profitable jobs.

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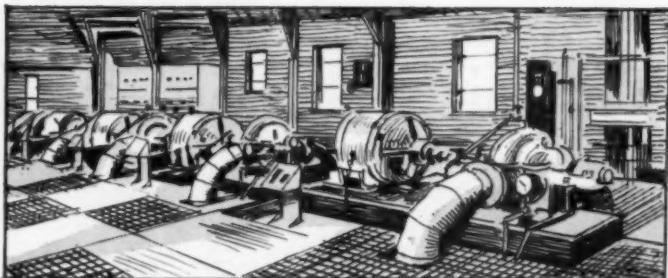
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THE
WATER
WORKS
DIGEST



Prepared by ALVIN R. JACOBSON, Ph. D.

Associate Professor and Head, Division of Sanitary Science, Columbia University School of Public Health

Automatic Valveless Filters

The community of Hyde Park, N. Y., was faced with a potential water shortage because the small plant using pressure filters, located on Crum Elbow Creek, could not meet the peak water demands. Three possible ways of increasing the supply were possible. The consultant recommended that, for reasons of economy, the existing plant be modernized and its capacity increased; that the creek be continued as the primary source with a well or wells as supplementary, or standby, water sources. Two 24-inch gravel-packed wells 30 ft. deep were drilled, one of them capable of delivering 300 gpm with present pumping facilities. The well supply had the disadvantage of containing a relatively high amount of iron and manganese and a treatment plant would be difficult to locate at the well site. It was planned, therefore, to treat the well water with sodium hexametaphosphate and chlorine before being pumped directly into the mains. A new treatment plant of more than 750,000 gpd capacity was built to treat the water from Crum Elbow Creek, the major source of supply for Hyde Park. This consisted of a 90,000-gallon steel sedimentation tank and three automatic valveless gravity filters, designed and fabricated by the Permutit Company. These automatic valveless gravity filters operate without the use of valves or other mechanical equipment. When filter head loss reaches a predetermined level, set by the design, a siphon is primed and the filter is automatically shifted into the backwash cycle. At the end of the backwash period, the siphon is broken and the filter is automatically returned to the filtering operation.

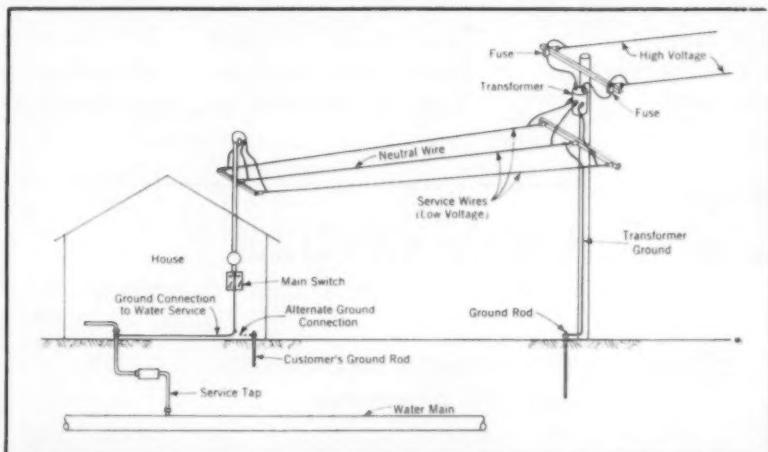
Only 0.75 percent (three-quarters of one per cent) of the system flow is used for backwashing, compared with 6 per cent for the old pressure filters.

"Automatic Valveless Filters Treat Water for Hyde Park." PUBLIC WORKS, July, 1961.

Water Pipe As Electric Ground

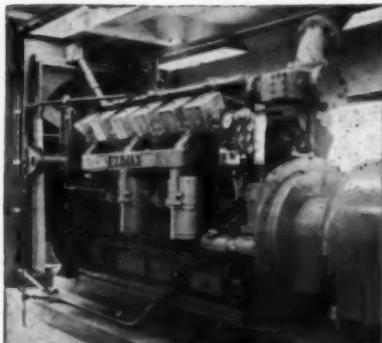
Electric services are grounded for the following reasons: 1) To protect persons and animals from hazards of electric shock; and 2) to protect buildings and their contents from fire. For over a half century the electric industry has based its use of water service pipe as electrical grounding on the following assumptions: 1) A metallic water service pipe is always proof of an electrically continuous metallic water system; 2) any repairs or replacements in the water system do not change its electrical characteristics; 3) electric currents flow in the water piping only momentarily during abnormal

conditions. The findings of the American Research Committee on Grounding, International Association of Electrical Inspectors (IAEI) special committee on grounding, and the many other committees and individuals who have investigated the grounding problem all prove conclusively that the above three assumptions are now largely false. Multiple electric services from one transformer do result in a continuous flow of alternating current on metallic water system piping; a metallic water service pipe does not indicate an electrically continuous, completely metallic water system; and the trend of water utilities to make repairs and replacements with nonmetallic materials probably will result in water systems that are useless for electric-grounding purposes. Herewith a typical residence is shown with electric service supplied by overhead wires and water furnished through underground pipe. The National Electrical Code (NEC)



Courtesy Journal AWWA

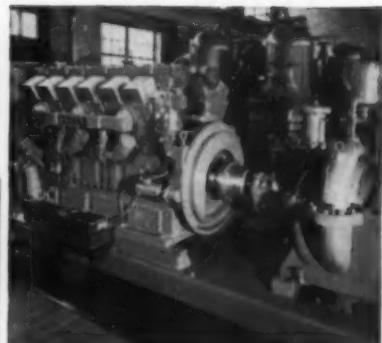
● DOTTED line shows grounding of customer's electric service to his own ground rod. Electric ground connection to water piping, also shown in cut, is not reliable.



Climax-driven 250 KW generator in St. Petersburg, Florida, water treatment plant protects against power failure.



Eight of fourteen Climax V-12 500 hp. engines powering storm water pumps for City of Saginaw, Michigan.



Model V-12 Climax engine in high capacity centrifugal pump service in a city water plant.

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Climax engines provide excellent low cost power for sewage and water treatment plants. These rugged, simply designed engines are engineered to give quick acceleration, withstand overloading, and perform longer with less maintenance.

natural or sewage gas
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60 to 600 max. hp.

CLIMAX
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MUNICIPAL ENGINES
60 — 600 max. hp.

model V85 — 250 max. hp

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OF WAUKESHA MOTOR CO.

BASIC MAX. ENGINE HP (Natural Gas and Gasoline) ①				600	700	800	900	1000	1100	1200	
MODEL	No. of Cyls.	Bore & Stroke	Displ.	Torque @ RPM	BRAKE HORSEPOWER AT SPEEDS INDICATED						
R-165	6	6½ x 7	1238	930 @ 750	105	123	140	156	170	183	192
K-67	6	7 x 7	1616	1240 @ 805	140	165	188	210	230	248	265
K-75	6	7½ x 7	1855	1410 @ 800	160	186	214	240	265	286	304
V-80	8	7 x 7	2155	1610 @ 850	178	210	241	272	300	323	340
V-85	8	7½ x 7	2474	1860 @ 900	207	249	285	317	345	370	390
V-122	12	7 x 7	3232	2440 @ 900	280	330	380	420	460	490	520
V-125	12	7½ x 7	3711	2880 @ 850	310	370	435	490	540	580	605

① Basic engine includes ignition, maximum carburetion, and water pump. Ratings indicate maximum horsepower.

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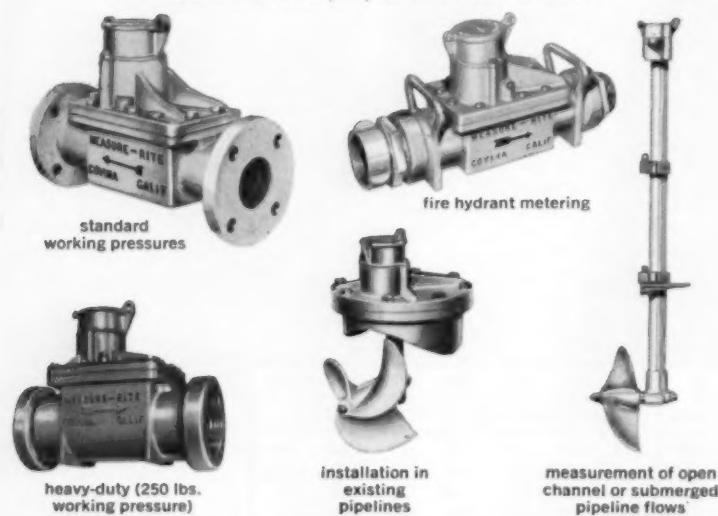
CL-123

Know our new address?



To handle expanding needs, Measure-Rite meters are now manufactured at our new, bigger Covina (Calif.) plant... where modern testing and production facilities assure better-than-ever service to you, our customers. Covina becomes the focal point for our nation-wide network of parts and service centers.

*from our production line,
Measure-Rite propeller meters for...*



Send for Bulletin MR-105 describing our complete line

Badger Meter Mfg. Company Measure-Rite Division

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requires the electricity customer to attach the ground wire to this pipe. It is being recognized that electric ground connection to water pipe is unreliable. For continuous protection, the customer's electric service should be grounded to his own ground rod. (Part I of a joint discussion).

The conclusions of the second author are in basic disagreement with AWWA policy on grounding but are presented here as a good statement of the electrical inspection authority's viewpoint on the matter. These conclusions are: 1) The water system is the best grounding means available today, even with asbestos-cement mains and plastic street connections, provided that there is more than 10 ft. of buried metallic pipe on the premises; 2) insulated fittings or dielectric couplings are of questionable value in preventing galvanic corrosion and greatly increase the hazards of shock and fire; they should not be installed in water services; 3) all pipe systems within a building should be electrically bonded together to reduce the fire and shock hazard; all isolated pipe systems should be bonded to grounded pipe; 4) there is no conclusive evidence that stray alternating currents from grounding on water systems materially influence electrolysis, electrolytic corrosion, or galvanic corrosion; 5) electric utilities, water utilities and inspection authorities should cooperate in preventing unnecessary currents on water systems. (Part II of a joint discussion.)

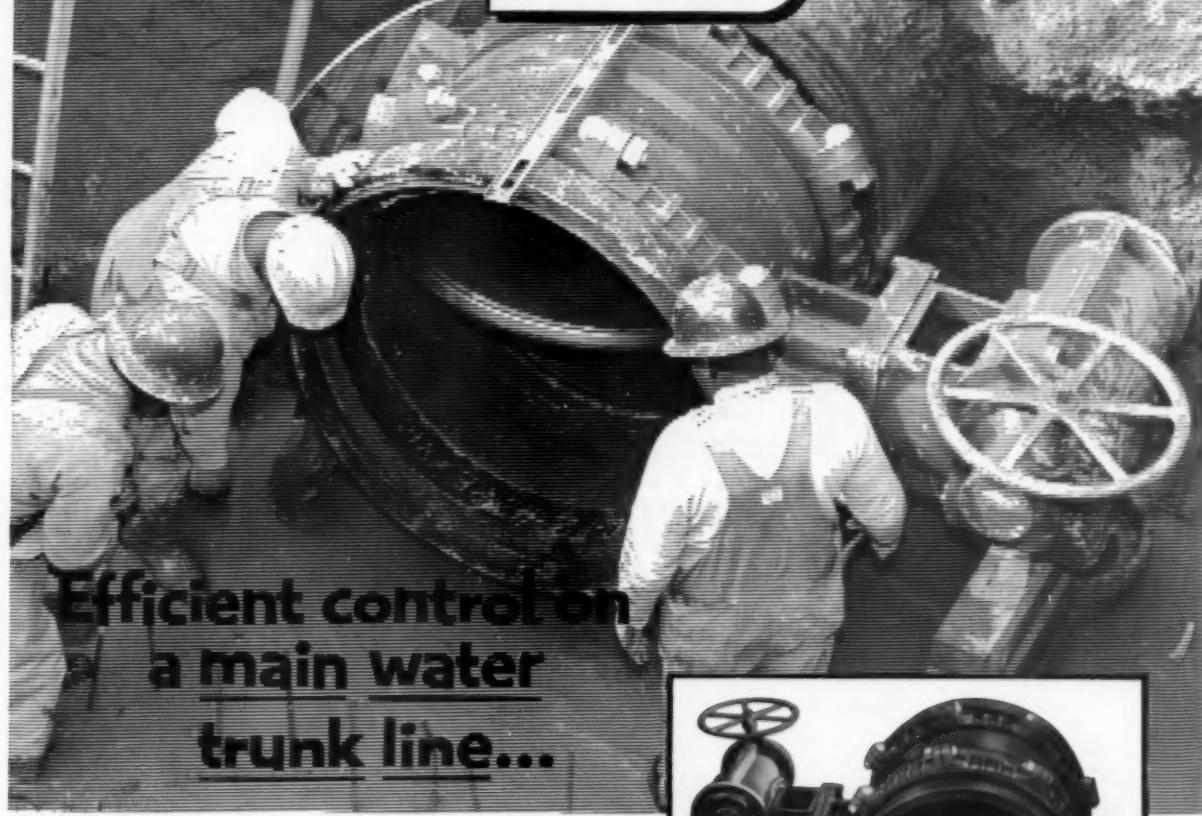
"Use of Water Pipe as an Electric Ground." Joint Discussion, Part I. By Lee B. Hertzberg, Supervising Mechanical and Electrical Engineer, East Bay Municipal Utility District, Oakland, Calif. Part II. By Arthur G. Clark, Los Angeles Dept. of Building & Safety, Los Angeles, Calif. *Journal AWWA*, June, 1961.

New Water Supply for a New Town

A water supply system is being designed for a new town—Incline Village, Nevada—to be constructed on a 9,000-acre tract along the north shore of Lake Tahoe for both permanent residents and many seasonal visitors due to its year-round recreational advantages. The master plan provides for development of a completely self-contained community of about 25,000 residents along Lake Tahoe, which is approximately 22 miles long and 12 miles wide, with water surface at elevation 6,-

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225 ft. Immediate intensive development will be concentrated upon the valley lands with the steeper slopes reserved for low-density, estate-type residences. After preliminary investigation it was concluded that the most feasible source of water supply would be from Lake Tahoe. This lake contains approximately 122-million acre-feet of exceptionally clear water which requires only chlorination for domestic use. It is planned to pump the water from the lake into storage tanks located on the higher slopes where it will flow by gravity into the distribution system. The project

supply facilities consist of three separate consecutive pumping lifts. The first pumping plant located on the lake shore lifts water from a submerged lake intake to a 1-mg. storage tank at elevation 6,691; the second lift will pump water to a storage tank at elevation 7,153; and the third lifts water up to another storage tank at elevation 7,615. Water flows by gravity from each storage tank through distribution mains to the usage areas, with pressures controlled by pressure-reducing valves between 50 psi and 100 psi in each pressure zone. A chlorinator will be provided.

"Brand New Water Supply for a Brand New Town." By G. F. Farrell, Special Projects Engineer, International Engineering Co. Water Works Engineering, June, 1961.

Water from Seaside Wells

Water pumped from seaside wells is often a salt solution the concentration of which rises through time according to a law which can be experimentally determined. The cycle will be repeated over and over again after an adequate period of time has elapsed since the previous cycle has been completed. A particular method is studied providing a more efficient well exploitation wherever salt concentrations would quickly rise above such limit as the cultivation-water-soil-climate-system can bear. It consists of filling a tank by several pumping cycles, these being suitably spaced and performed between two subsequent irrigations, and of effecting the salt-blending process even while irrigation is in progress, conveying from the well into the tank the same discharge as is delivered from the tank into the distribution canals. For a given limit concentration, irrigation may thus be continued for a considerably longer time than the sum of the time required for emptying the tank and the time during which the water could otherwise be pumped directly from the well into the distribution canals. Diagrams are furnished, together with a table providing a ready means for calculating the capacity of the tank required for any given irrigation time, as well as the number and duration of the tank-filling pumping cycles.

"The Use of a Well Supplied By a Fresh Water Aquifer Overlying a Salt Water Aquifer for Irrigation." By Guglielmo Benfratello, Ingénieur-Professor Libre d'Hydraulique, Assistant a L'Ecole Polytechnique de Milan, Charge du Cours d'Hydraulique Agricole a L'Université Catholique de Milan. *La Houille Blanche*, Janvier-Fevrier, 1961 (Boite postale 41, Grenoble, France.)

Evaporation Suppression

Various phases of evaporation suppression have been carried out during the past two years at Stanford University. Considerable work has been done in the laboratory, using the Langmuir tray, attempting to find a chemical or combination of chemicals or an additive that could be mixed with hexadecanol to



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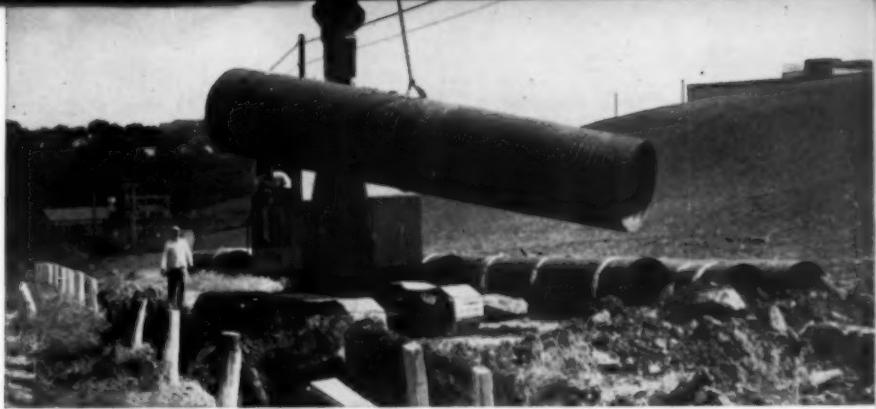


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give a film with superior healing qualities while retaining proper evaporation inhibiting characteristics. This work has not yet produced any promising results. Numerous evaporation pan tests were conducted using metal pans 47.5 in. in diameter and 10 in. high filled with water to a depth of 7 in. Various dosages of chemicals were placed on the water surfaces in the pans and were compared with one pan filled only with water as a control. These tests showed that: 1) The largest dosages were most effective and persisted for a long

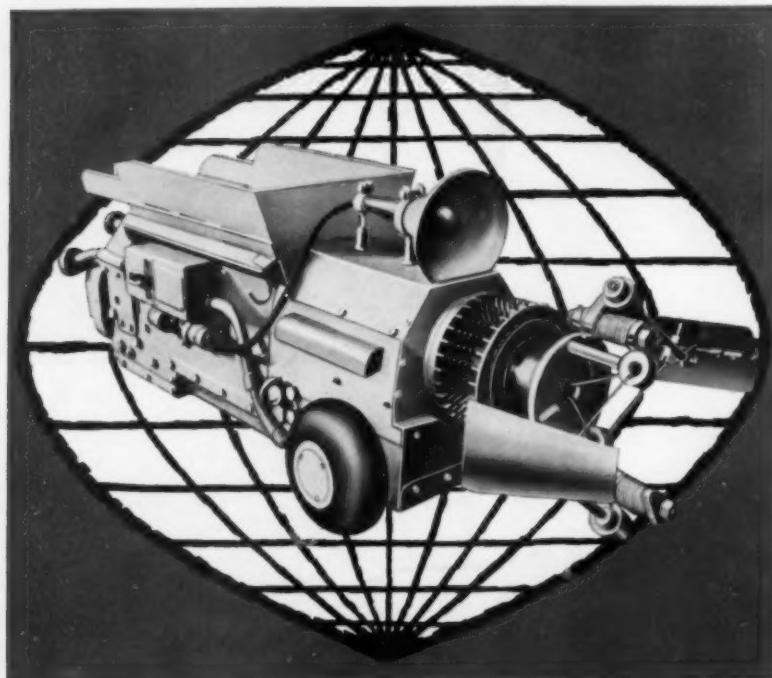
period of time; 2) that a chlorine residual apparently impeded bacterial activity giving the film greater effectiveness and longer life; 3) that the initial hexadecanol dosages of 3 lb. per acre lost its effectiveness in about six days indicating that the rate of bacterial attraction may have approached 0.5 lb./acre/day. It was shown that applying a small dosage each day was much more effective than applying one large initial dosage. A full-scale evaporation suppression testing program was carried on during the summer of 1960 at Felt Lake, a 40-acre lake on the

Stanford University campus, using a film on—film off procedure; i.e., a several day period with film followed by several day period without film and then repeating the procedure. Using the pan coefficient approach of evaluating the percentage reduction of evaporation, it was shown that a 19 percent reduction of evaporation resulted. The powdered hexadecanol was dispensed by hand from a boat during this study. Attempts to develop a dry feed dispenser have thus far been unsuccessful. A dispenser was built and tested for dispensing hexadecanol in the molten state which proved reasonably satisfactory, however, several refinements in design were indicated. The author believes it is entirely possible to save water by the application of monomolecular films on reservoirs at a cost ranging from \$20 to \$35 per acre foot.

"Evaporation Suppression Research". Part II. By Joseph B. Franzini, Associate Professor of Civil Engineering, Stanford University, Stanford, Calif. *Water & Sewage Works*, June, 1961.

Murfreesboro's New Water Plant

Murfreesboro, Ark., negotiated an agreement with a poultry processing company to build a plant in this community of 1,100 people, which would have a considerable influence on its economy. Included in the negotiation was the agreement that the city would furnish the water required to operate the new poultry processing plant. After considerable test drilling and other investigation, it was decided that the Little Missouri River was the only potential source of water which would be satisfactory from the standpoint of quantity and quality. The eventual site developed was located about 5 miles up the river from Murfreesboro, above the confluence with Muddy Fork Creek and near Narrows Dam. An infiltration gallery was constructed with a total of 350 feet of 10-inch corrugated metal perforated pipe installed, 100 feet downstream from the structure and 250 feet upstream, all paralleling the river bank. Pumping tests showed that there was insufficient water coming into the infiltration gallery. To overcome this problem a trench 6 ft. wide was excavated from the infiltration gallery to the river and was back-filled with sand and gravel. Pumping tests indicated a pumping rate of just under 600 gpm could be



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utilized. The total construction cost of the project was \$59,728.

"Chicken Processor Brings Jobs—Town Must Then Bring Water." By George M. Sallwasser, Assoc. Engineer, Marion L. Crist Associates, Consulting Engineers. *Water Works Engineering*, June, 1961.

Sludge from Lime-Soda Softening

This article pertains to the results of electrophoretic studies of sludge particles produced in lime-soda softening. The electrophoretic mobilities of the particles of CaCO_3 and

Mg(OH)_2 , formed by softening various combinations of two synthetic waters with lime were measured. The zeta potential of Mg(OH)_2 was found to be positive throughout the entire pH range encountered in lime-soda softening. The zeta potential of the particles of CaCO_3 was found to be negative in the absence of magnesium, but the potential became less negative and finally became positive as the ratio of magnesium to calcium in the water being softened was increased. The zeta potential of the negative CaCO_3 particles was also reversed to positive values by the addition of

MgCl_2 after softening. It was also shown that ions present in the water being softened, particularly multivalent ions, will affect the zeta potential of floc particles. The effects of four coagulant aids were studied, especially their effects on floc mobility, coagulation, and settling. The anionic aids were found to increase the negative zeta potential of CaCO_3 floc particles, whereas cationic aids had the opposite effect, reducing and finally reversing the zeta potential of CaCO_3 particles from negative to positive. The nonionic aid, as would be expected, had no effect on particle mobilities and little effect on coagulation and settling.

"Electrophoretic Studies of Sludge Particles Produced in Lime-Soda Softening." By A. P. Black, Research Prof. of Chemistry & San. Science, and Russell F. Christman, Research Asst., both of the Dept. of Chemistry, Univ. of Florida, Gainesville, Fla. *Journal AWWA*, June, 1961.

Other Articles

"Coatings for Street Water Storage Tanks." A discussion of the various coatings for the interior and exterior surfaces of steel water storage tanks. By D. W. Christofferson, Chicago Bridge & Iron Co., Chicago, Ill. *Journal AWWA*, June, 1961.

"Gathering and Use of Water Quality Data." A series of papers presented on Aug. 29, 1960 at the Symposium on Water Quality Measurements and Instrumentation, Cincinnati, O. With Samuel S. Baxter who spoke on Utility Needs; Paul D. Haney on Consulting Engineering Needs; Milton F. Schable on Industry Needs; K. S. Krause on Federal Needs; and Conrad P. Straub on Significance of Radioactivity Data. *Journal AWWA*, June 1961.

"How To Rehabilitate A 30-Year-Old Water Main." Cement-mortar lining 14,000 feet of water line improved hydraulics and reduced pumping head and costs at Detroit. By Melbourne G. Stewart, Water System Engineer, Detroit Board of Water Commissioners. *Water Works Engineering*, June, 1961.

"How Holyoke Developed A 17-Mgd Three-Pressure-Zone Water System." "Drought Insurance" is provided by six reservoirs which serve areas ranging from elevation 50 to elevation 600. By George H. McDonnell, Chief Engineer, Tighe & Bond, Consulting Engineers. *Water Works Engineering*, June 1961.

"Pumping Water At Variable Speed With Efficiency." The first waterworks installation, using a new type of adjustable speed drive, was made recently at Syracuse, N. Y. By Adam W. Kubik, P. E., O'Brien & Gere, Consulting Engineers, Syracuse, N. Y. *Public Works*, July, 1961.



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Federal Specification For Cement Mortar Lined and Reinforced Mortar Coated Steel Pipe

Interim Federal Specification FS-SS-P-00385 provides designers of water systems with a single recognized specification complete with protective lining and coating that covers pressure pipe from 4-in. through 42-in., for working pressures up to 400 psi. Developed by the Bureau of Reclamation, Department of Interior, FS-SS-P-00385 establishes standards by which cement mortar lined and reinforced mortar coated steel pressure pipe can be ordered by class designation from Class 100 through Class 400 for the equivalent working pressures in psi.

Steel pressure pipe, cement mortar lined and reinforced mortar coated, derives its design pressure rating from a single component steel shell. The wall thickness of the steel shell is computed on the basis of having a maximum stress of 15,000 psi in the steel at the design pressure but the shell must be not less than #14 US gauge. The steel pressure design is based on use of steels having a minimum yield of 30,000 psi, thus allowing a safety factor of 2 at the yield point of the steel.

The use of a single component shell offers many advantages to the customer. The heavier steel cylinder greatly simplifies field tapping and field fabrication of specials. Due to the single component design of the pressure cylinder, every length of the cement mortar lined and reinforced mortar coated steel pipe is hydrostatically tested to at least 1½ times design working pressure before delivery to the customer.

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In their review of the proposed specification, the Bureau of Reclamation referred to the tremendous amount of test data built up on cement mortar protected steel pipe over a period of many years. It also considered the actual field experience with this type of pipe. The Bureau of Reclamation adopted the design standards set forth in FS-SS-P-00385 on Bureau projects last fall and these have been used in their latest projects.



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INDUSTRIAL WASTE DIGEST



Prepared by CLAYTON H. BILLINGS, Associate Editor

Underground Disposal of Wastes

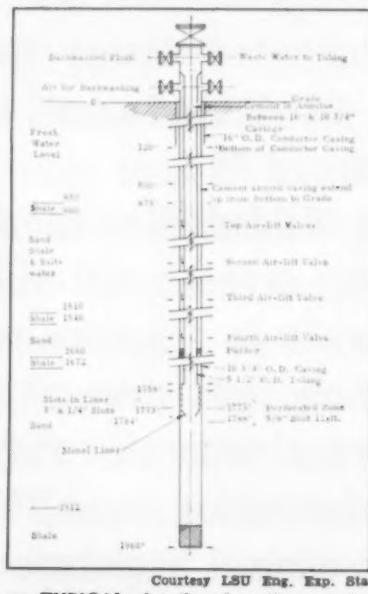
Although the Shell Chemical Co. plant at Norco, La., located on the Mississippi 25 miles upstream of New Orleans, has an elaborate waste treatment facility, the firm started development four years ago of underground waste disposal techniques. This work was undertaken as insurance against special problems that might arise from new process methods in manufacturing. The first well drilled at Norco in 1956 was exploratory and designed to inject waste into a sand formation existing at a depth of 1670 to 1900 ft. The formation had been used for salt water disposal successfully, was known to be highly permeable and opens into the Gulf about 250 miles from Norco. The natural water in the formation contains about 5 percent sodium chloride, making it unacceptable for drinking purposes. The well is cased the entire depth and has a cement grout annular seal to avoid contamination of fresh ground water. An interior injection casing was installed, equipped with air lift valves to facilitate backwashing and a packer was installed between the injection and other casings. This arrangement permits pressurizing the annular space between the two casings with Mississippi River water, assuring positive flow into the disposal formation at all times. Experiences with operation of the well resulted in developing an index to judge performance. This index is mathematically expressed as the ratio of the waste water flow to the net pressure forcing the waste water into the sand, the net pressure being the difference between the pressures developed at the well head and in the hole at the point of injection. The constituents of the waste were calcium and sodium chlorides, dissolved organics and

suspended silica and calcium carbonate. Suspended solids varied from 150 to 700 ppm. A pH of 10 has been found optional by varying it and comparing it with the index of performance. Well head pressures of about 140 psig are required to inject 400 gpm of waste water. Based on this experience, a second well has been drilled to handle wastes from the new acrolein and glycerine units of the plant.

"Underground Disposal of Industrial Wastes." By J. G. Moffett, Jr., Shell Chemical Co., Norco, La. Proceedings of the Twenty-third Annual Louisiana Water and Sewerage Short Course, L. S. U. Eng. Expt. Station Bulletin 65, 1961.

Electrolytic Purification

A method has been developed in Norway by Ernst Foyn for precipitating phosphates in sewage and



● TYPICAL details of well used for underground disposal of industrial waste.

other wastes by electrolysis. The method has been applied primarily to control conditions in the Oslofjord. Aquatic life was being destroyed in the fjord by the discharge of sewage, and prolific algae growths resulted from over-fertilization of the fjord with excessive phosphorus and nitrogen compounds. The algae growth caused darkness at lower depths preventing photosynthesis; this in turn resulted in oxygen deficiencies. Conventional sewage treatment processes have difficulty with phosphorus compounds and do not remove nitrogen. The Foyn method consists of adding sea water to sewage to supply magnesium and then applying electrolysis to provide the necessary alkalinity. The process results in production of chlorine gas which can be used for disinfection of the effluent. Phosphates are precipitated to the extent necessary to control fertilization of the fjord. Pilot plant tests showed that it was possible to handle one cubic meter per hour by 200 amps at 5 volts, resulting in a power requirement of one kilowatt hour per cubic meter and a retention period of less than one hour. A semi-commercial plant has been operated by Oslo since 1958. So far the average phosphorus content of the effluent has been less than one mg/L and nitrogen has been reduced to less than 0.28 mg./L.

"Electrolytic Sewage Purification." Contractors Record and Municipal Engineering, (London), May 24, 1961.

Irrigation Disposal of Wastes

Spray irrigation methods were first applied to cannery wastes, because seasonal operation is not conducive to other disposal methods and the wastes are produced at a season when grass can be depended

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upon to remove much of the water by transpiration. Since growing crops can remove about 5,000 gal. per acre per day, designs have usually been based on use of sufficient area so that an application rate of 10,000 gal. per acre per day will not result in runoff. The next application of spray irrigation was to dairy wastes, but since this is a year-round operation, difficulty is experienced with maintaining the grass crop through alternate thawing and freezing. Twice the design area employed for canning wastes is required for dairy wastes, because of this problem. Ridge and furrow irrigation has been developed for dairy wastes, using the same area as required for summer spray irrigation. Furrows are usually one foot wide and six inches deep, with ridges from five to eight feet wide. Grasses are permitted to grow tall so they will fold over the furrows and help avoid freezing of the disposal area in winter. Poultry and meat processing and pulp mill wastes have been handled by irrigation. With sulphite liquor, spraying from a tank truck has been employed, using a land requirement such that total solids application does not exceed

one pound per square yard per day. Care must be exercised to avoid ground water pollution in any of these methods. Creviced limestone areas should not be used; soil borings can be used to select sites.

"Irrigation Disposal of Industrial Wastes." By Theodore F. Wisniewski, Director, Wisconsin Committee on Water Pollution. PUBLIC WORKS, July, 1961.

Progress in Waste Treatment

Basic data on the effects of industrial wastes on water pollution are very limited and projects are under way to make up the deficiency. A questionnaire survey recently completed involved compilation of replies from state regulatory agencies to questions on the number of municipalities and industries providing treatment of wastes in 1950 and in 1960, the number in each category requiring treatment in those years, and the number currently needing improvement in existing facilities. Forty-two questionnaires were distributed and 38 were returned, of which 26 had complete data. An analysis of the totals for the 26 states indicates a 74.5 percent increase in municipi-

pal treatment facilities and a 64 percent increase in industrial waste treatment in the past decade. During the same period there was a decrease in needs of 36.5 percent among municipalities and 44 percent among industries. Industries show less increase in waste treatment, but a greater decrease in needs. This reflects a trend toward consolidation of small plants and a movement of industries into cities, trends that reduce needs in industrial waste treatment without building separate industrial waste treatment plants. In 1950, 48.5 percent of the municipalities and 46.5 percent of the industries that needed treatment had treatment facilities. In 1960 these figures rose to 72.2 percent of the municipalities and 71.7 percent of the industries.

"Where Industry Stands in Water Pollution Control." By A. J. Steffen, Manager of Sanitary Engineering, Wilson and Co., Chicago, Ill. Journal WPCF, June, 1961.

Soil Building With Wastes

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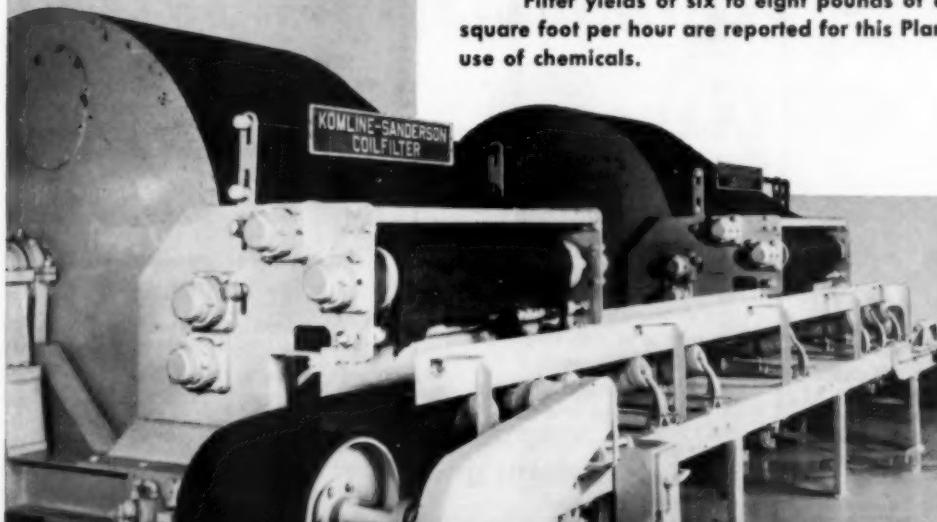
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residues for return to the soil. There are a number of wastes shown to be capable of contributing valuable soil ingredients. Among these are by-product wool shreds from carpet manufacture which provide available nitrogen comparable to castor pomace. Cane trash and bagasse from the sugar cane industry have been found helpful in Hawaii in reducing soil compaction. Poultry feathers have been reduced by pressure cooking to a fertilizer containing 12 to 13.5 percent nitrogen. Whey from cheese manufacture can be applied directly as a

fertilizer for grasses, corn and alfalfa. A ton of whey contains appreciable quantities of nitrogen, phosphorus, potassium and lesser proportions of other materials. It is possible that tung hulls can be used to substitute for peat. Tankage from meat packing wastes can be processed to produce a dry fertilizer containing 7 to 10 percent nitrogen and 10 to 15 percent phosphorus. Dried blood has a nitrogen content of 10 to 17 percent.

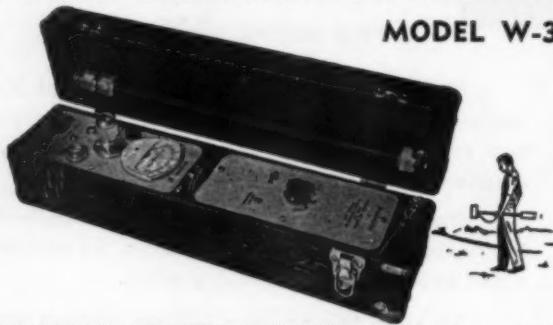
"New Use for Problem Wastes." by Jerome Olds. *Compost Science*, Spring, 1961.

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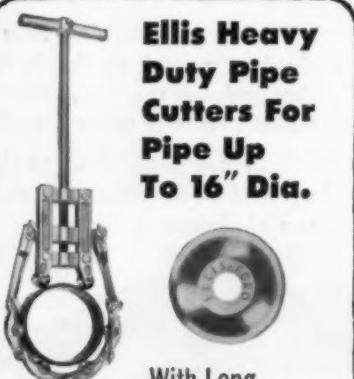
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Other Articles

"A Review of the Literature of 1960 on Wastewater and Water Pollution Control, Industrial Wastes." This summary by the Research Committee of the Water Pollution Control Federation covers literature on wastes from food processing; meat packing and poultry dressing; fermentation, chemical and pharmaceutical industries; coal production; byproduct coke production; petroleum processing; pickling, plating, and metal finishing; pulp and paper production; and handling of radio-active materials. *Journal WPCF*, June, 1961.

"Biological Oxidation Plant Operating Experience with Industrial Waste." By R. A. Ratliff and R. T. Weaver. A report on treatment of wastes from the Ponca City, Oklahoma and Denver, Colorado refineries of the Continental Oil Co. *Proceedings of the 23rd Annual Louisiana Water and Sewerage Short Course*, L. S. U. Eng. Expt. Sta. Bull. 65 1961.

"Designing Biological Oxidation System for Industrial Wastes. Part 2." This installment outlines oxygen utilization and sludge growth relationships. By W. Wesley Eckenfelder, Jr. *Wastes Engineering*, June, 1961.

"Finding the Best Way to Treat Wastes from a Blanket Mill." By Arthur L. Smith, Joe Layell and John C. Grey, Chatham Manufacturing Co. Summary of four-year pilot study on aeration of liquid wastes. *Wastes Engineering*, May, 1961.

"Acrylonitrile and Zinc Wastes Treatment. Part 2." By Ronald D. Sadow, Dow Chemical Co., Williamsburg, Va. This article discusses the start-up problems and operation of wastes treatment plant for a firm manufacturing Zefran synthetic fiber. *Industrial Water and Wastes*, May-June, 1961.

"Electro-Platers Issue 'Housekeeping' Rules." Masters' Electro-plating Association of New York works with the City of New York in minimizing waste loads. *Wastes Engineering*, May, 1961.

• • •

Improving Highway Engineering Productivity

A regional conference on Improved Highway Engineering Productivity will be held at the Somerset Hotel, Boston, Aug. 24 and 25. Workshop sessions will be held on new methods in location and design; bridges and the use of computers; electronics in urban operations; electronics in management; and the impact of electronics on new equipment, methods and specifications. W. D. Dillon, Division of Development, Bureau of Public Roads, Washington 25, D. C., can furnish information on the meeting.



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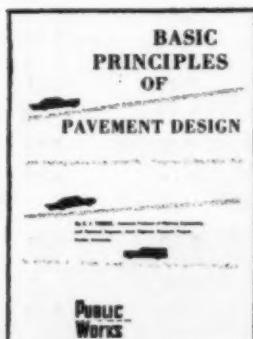
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Storm Drainage Problems and Solutions

This is a portion of a paper by A. L. Tholin, Engineer of Public Works, City of Chicago, presented at the Conference on Environmental Engineering and Metropolitan Planning at the Technological Institute, Northwestern University, Evanston, Illinois.

THE Metropolitan Sanitary District of Greater Chicago, which constructs and operates sewage treatment works for Chicago and its vicinity, has constructed low-level intercepting sewers at or near the banks of the Chicago and Calumet Rivers, the Sanitary and Ship Canal and their tributaries. At each point where the intercepting sewers pass under a combined sewer, a control structure diverts to the interceptor all dry-weather flows plus a predetermined percentage (usually 75 to 200 percent extra) during storm periods. Flows over and above these quantities discharge into the open watercourses. Although these overflows may have short-duration rates as high as thirty times dry weather flow (higher for individual new outlets), the annual volume of the sewage spilled has been estimated to be only about three percent of the total of household and industrial wastes.

The question has been raised as to whether Chicago might construct a system of sanitary sewers to minimize or eliminate river pollution. From studies it has been estimated that a separate and complete new system for all household and industrial wastes would cost approximately \$2.5 billion. This represents an average cost over the city of \$17,500 per acre—an impossible expenditure. Since there are few unserved areas left within the City, Chicago can be expected, therefore, to continue to operate its primary drainage systems on a combined sewer basis.

The Chicago situation is typical, with variations only as to sewer patterns and sewage quantities, of most other major cities of the United States. It has been demonstrated by Camp, Greeley and Langdon and others that increasing the ratio of maximum flows intercepted from a value of two times dry-weather flow to five times dry-weather flow would reduce the annual pollution caused by spillage at overflows from about 3 percent to

only about 2 percent of the total pollution originating from within the drainage areas.

For two decades prior to the close of World War II, the people of Chicago endured the flooding of hundreds of thousands of basements and scores of underpasses during heavy storm periods. At the close of the War, the City embarked upon the most extensive sewer building program in its history. It was soon discovered, however, that the elimination of these basement flood-control reservoirs by more adequate drainage to the watercourse created new problems of flooding. In October, 1954, bank overflow in the heart of the City caused damages estimated in excess of \$10 million.

The bank overflow in 1954 could have been prevented by opening the gates at the navigation lock in the mouth of the Chicago River, but it had been deemed hazardous to Chicago's water supply to allow the polluted river water to enter Lake Michigan. By the time of the next critical rainstorm in July, 1957, the rules regarding river control had been somewhat modified to allow

the release of part of the peak flood-flows into Lake Michigan. This is still considered to entail some hazard to the water supply, but is being allowed under careful control and observation, pending completion of Chicago's water filtration program in 1963. Plans have also been developed to increase the discharge via the Des Plaines to the Illinois River valley.

Detention Storage of Unpolluted Runoff

The perspective of the sewerage-river relationship has a somewhat different aspect if sewerage is on a separate basis rather than combined. If stormwater drainage channels within an urbanized area are kept unpolluted, surface detention of water during peak flows provides a means of economy in flood control and flood-damage prevention. Development of recreational areas along stream valleys can often be planned in such a way that small recreational waters are available in dry-weather and moderately rainy seasons, while, during periods of heavy runoff water levels are allowed to encroach, temporarily, upon a flood plain. If the flooding of the recreational flood plains is infrequent and of short duration, sod and landscaping will not be damaged; and if pollution is absent, only minor cleanup expense will be incurred.

Table 1—Maximum Recorded Average Rates of Precipitation (in./hr. at Chicago, 1871-1959)

Month	Time Interval				
	15 min.	1 hr.	3 hr.	6 hr.	24 hr.
Frozen Months:					
November	1.96	1.00	0.46	0.25	0.08
December	1.84	0.59	0.40	0.22	0.10
January	2.12	0.62	0.31	0.25	0.12
February	0.78	0.36	0.27	0.25	0.06
March	2.12	0.95	0.63	0.37	0.11
Non-frozen Months:					
April	3.40	1.57	0.75	0.48	0.17
May	3.52	1.39	0.77	0.44	0.12
June	4.92	2.47	1.52	0.76	0.19
July	4.72	2.81	1.28	0.92	0.26
August	4.88	2.02	1.05	0.57	0.13
September	5.24	2.15	0.80	0.46	0.11
October	3.80	1.59	1.06	0.65	0.23
5-yr. Storm	4.00	1.77	0.76	0.43	0.13
100-yr. Storm	6.70	3.05	1.34	0.77	0.24
Ratio of Maxima:					
Frozen to Non-frozen	0.40	0.35	0.41	0.40	0.42
Snow Melt Needed to Make Ratio Exceed 0.50					
Exceed 0.50	0.50	0.40	0.13	0.09	0.02

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PUBLIC WORKS for August, 1961

Even within the stormwater drainage systems, it is often possible with favorable topography to interrupt a local stormwater drainage system with a neighborhood park in a depression or small ravine. One or more stormwater outlets may be directed into such a depression, and the size of the outlet from the area restricted in capacity to moderate runoff rates, using detention storage to equalize the inflow-outflow relationship.

When the outlet from a local detention basin discharges into an underground stormwater drainage system of limited capacity, and there is no available surface channel for flows in excess of such capacity, it would seem to be mandatory that the detention basin be large enough to hold the total runoff (less the safe quantity of outflows through the underground system) from at least the maximum storm of record.

Local Detention Storage

At Chicago-O'Hare International Airport, the Terminal Area includes about 300 acres of concrete apron and paved parking area besides numerous taxiways, roadways, building roofs, etc. The paved area will ultimately increase to 700 acres. The area was formerly occupied by marshland and truck gardens. A small creek with a bankfull capacity of about 100 cfs, drains this portion of the Airport to the Des Plaines River.

A borrow pit covering more than fifty acres was excavated to obtain fill for embankment needed under runways, etc., and is thus available as a flood detention reservoir. A control structure is to be built where the deepened creek channel leaves the borrow pit, so as to restrict the maximum outflow to about 100 cfs. Consideration is being given to the installation of rate-of-flow control by use of hydraulically operated butterfly valves with remote control from a downstream point.

The combined capacity of stormwater sewers entering the borrow pit is 1650 cfs. The maximum fluctuation in water surface during the maximum recorded rainfall will be about eight feet. The maximum surface area of the pond will be about 75 acres. The utilization of the borrow pit as a detention reservoir has thus reduced the needed outlet channel capacity to 1/12 or less (allowing for other local flows) of that which would have been required without such a reservoir. To a much lesser degree, but nevertheless in a real amount, the



Figures don't lie, if you examine all facets.

—Bob Sproule

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When applying liquid chloride, you may want to contract for the unloading, hauling, and applying. The total tab is usually about the same as your own cost when you purchase the chloride in bags.

See the possibilities? They're well worth investigating, if you use enough chloride. And, incidentally, liquid chloride has two big advantages for dust control: It's easier to spread, and it starts to work faster. If you'd like details, write: Wyandotte Chemicals Corporation, Dept. FS, Wyandotte, Michigan.

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reservoir will reduce flood peaks in the Des Plaines River.

A medium-sized shopping area situated on a side hill location in a Chicago suburb having a low-capacity drainage system was able to create a four-acre stormwater storage reservoir by surrounding a vacant block with earthen dikes. Stormwater runoff from the shopping area entered the reservoir by a 48-inch sewer, and exited through a 15-in. line. Dikes were approximately eight feet in height and were not topped by floodwaters of the maximum storms of 1954 and 1957.

In a paper by Daily, before a meeting of Highway Engineers in 1960, are presented some interesting examples of proposed stormwater detention basins in the urban area of Memphis, Tenn. In one rapidly developing 3500-acre watershed, approximately 900 acres are so situated as to allow the installation of eight small detention basins at an estimated cost of \$145,000. The savings effected in the total drainage systems for the 900 acres, by the use of detention basins, is estimated to be \$470,000, or three times the cost of the basins.

It is wisely pointed out by Daily, that detention basins should be planned for storms of considerably

less frequency and consequently higher intensity than those for which the downstream outlet is planned, unless safe surface conveyance for excess flows is available in the downstream area. The writer of this paper believes such detention basins in urban areas should be designed for, at least, the maximum storm of record.

Flood Control Design

Where detention reservoirs and channelization improvements are planned in the valleys of open watercourses in urban areas, and a long record of gatings is available, it becomes necessary to interpret and correlate the gatings with regard to effects of increased urbanization.

This problem has been the subject of much discussion by members of the Technical Advisory Committee on Flood Control of the Northeastern Illinois Metropolitan Area Planning Commission. Dr. Gilbert F. White is chairman and the writer is a member.

Ralph G. Berk, another member of the above Committee, recently presented a brief review of flood records in the Chicago area based on gatings over a 50-year period. These tended to show that increasing urbanization in a near-in sub-

urban fringe area had little effect upon peak flows in the area's principal stream, the Des Plaines River. It appears that flow records known to have been made when rain fell on frozen ground, even when suburban development was relatively light, will not be greatly exceeded when the area is fully urbanized. This is an interesting observation and not without merit, since the overall imperviousness of a sparsely populated area with frozen ground will probably never be equaled by full urbanization and a non-frozen condition.

There are, of course, other factors such as more rapid delivery of stormwater to the stream and reduction in surface pondage, as urbanization increases. Nevertheless, the concept of urbanization as substituting roofs and pavements for hard frozen ground is worth further discussion.

In examining the runoff data for urbanized areas, with and without frozen ground conditions, it is of interest to note the record of relative rainfall intensities which have occurred in the frozen and non-frozen months.

Table 1 shows maximum recorded rainfall intensities, for various time intervals, classified by month of oc-

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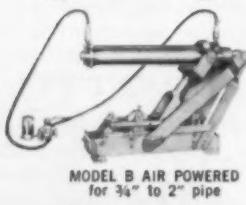
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currence. The months of November to March, both inclusive, are classified as "frozen," since during all or portions of these months the ground is normally frozen. The dark-faced figures indicate the maximum values in each of the two categories. Also shown are intensities computed from locally accepted rainfall intensity-duration-frequency curves for a 5-year and 100-year frequency.

It will be noted that the ratio of the maximum values of the two categories is nearly uniform with an average value of 0.40. This indicates that, for the eighty-eight years of record, the maximum rainfalls on frozen ground had intensities equal to only about 40 percent of the maximum intensities occurring in the non-frozen months.

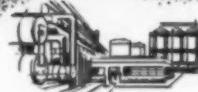
If runoff is related to rainfall as expressed in the formula for the Rational Method for estimating runoff, the coefficient of imperviousness in the non-frozen months would need to be only 40 percent of that in the frozen months to produce the same rate of runoff.

It seems to the writer that full urbanization, without any frozen surface, would almost surely demand the use of a coefficient of imperviousness at least half as great as that for a frozen surface condition. Since only four-tenths times summer maximum rainfall intensities is equal to 100 percent of "frozen month" maxima, the runoff rates in summer months can be expected to become, with full urbanization, 25 percent greater than those in the winter months. For example, using the maximum figures in Table 1 for 6-hour duration, and assuming "C" for the maximum recorded rainfall on frozen ground was, and may again become, 0.80, then the unit runoff, "C I" for frozen ground becomes 0.296 inch per hour. If we then assume that the record rainfall in non-frozen months would recur after urbanization, so as to indicate a "C" value of 0.40, the unit-runoff, "C I", would then, by the same theory, become 0.368 inch per hour, or 25 percent greater than the record for the frozen months.

Examining the tabulation further, however, it can be seen that as durations increase, the numerical increment of precipitation necessary to add to the "frozen month" records in order to make it equal to one-half of the "non-frozen month" records decreases.

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this differential is too great to represent any reasonable rate of snowmelt. For the 15-minute period it would be impossible.

This analysis leads, therefore, to a general, but not accurately defined conclusion as follows: In the Chicago climate, maximum, low-frequency future floods are most likely to occur in small drainage areas during the non-frozen months; and, conversely, will most likely occur in large drainage areas (with concentration times greater than 2 or 3 days), during the frozen months. In the larger areas, therefore, the future floods may not exceed the record flood of like frequency, which was known to have occurred during a period of frozen ground, unless reductions are made in upstream or up-sewer detention storage such as by emptying flooded basements through more adequate systems. In small areas, however, previous records can be expected to be surpassed as urbanization increases. Rates and upper limits of urbanization must be assumed and their effects on runoff evaluated before determining size of conduits, channels, detention basins or other sewerage, drainage and flood control facilities.

Considerable alleviation of flood damage and the cost of prevention could be obtained in urban areas by encouragement of detention devices at or near the source of the stormwater. In Chicago, when new factories have been established in recent years in areas of inadequate sewerage, the City has required the temporary detention of rainfall on flat roofs by insertion of limited capacity connections to the sewer system. In some instances this has been done by special roof drain fittings so as to retain 3 to 5 inches of water for subsequent release.

In planning new residential developments, the local detention of roof runoff on grassy areas or small permanent pools, with adjacent, self-draining berms should be encouraged. Open landscaped or recreational areas in parks or school sites can be so connected to routing runoff from roofs, parking areas, etc., that for the once-a-year or greater intensity rainfall, the excess quantities may be temporarily detained on open turf areas.

Preserving Flow Channels

One aspect of the drainage problem which is gaining increased attention of engineers and planners is

the establishment, maintenance and preservation of flow-ways.

To accomplish this requires a master plan of development, the determination of a basic pattern of drainage, with estimate of near-future and ultimate rates of flow to be expected in all principal watercourses, and the selection and establishment of detention reservoir sites.

Maps showing probable and possible extent of flooding, together with stream profiles showing estimated floodwater elevations should be obtained. The Northeastern Illinois Metropolitan Area Planning Commission has recently asked the United States Geological Survey to obtain a series of flood charts covering much of the Chicago Metropolitan Area. Advance prints of the first chart (covering a suburban area south of Chicago) have been received and are being reviewed. Such maps will form a factual background for regulation and control. The chart shows the extent of flooding during the maximum flood of record; flood profiles and data on other large storms; and gives estimated recurrence intervals for various flood stages at a few specific points along the watercourses.

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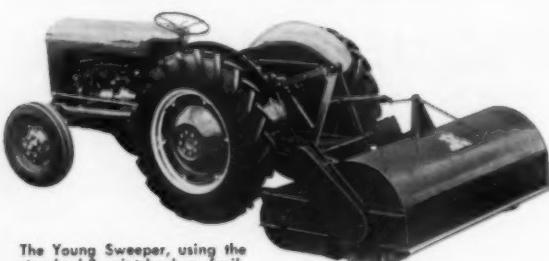
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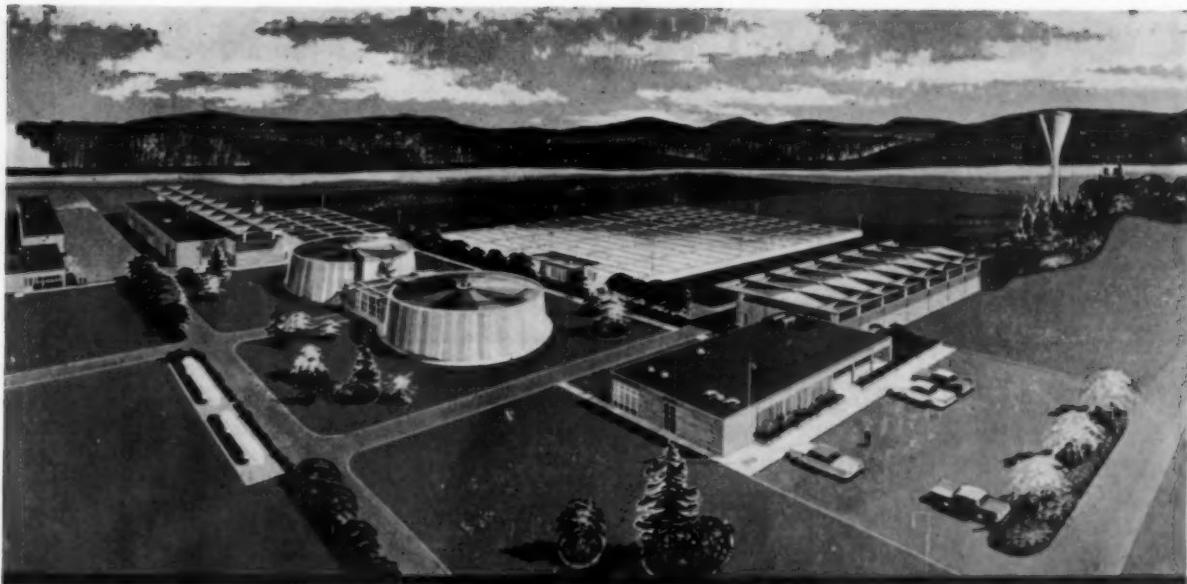
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The plant itself will cost about \$11 million but much additional work is involved. One of the difficult projects involves the crossing of the north arm of the Fraser River by three 66-inch concrete conduits and the construction of a 2½-mile tunnel. It is estimated that the overall cost of the presently projected work will be about \$19 million and the ultimate cost perhaps \$30 million. The large flow volume and the correspondingly large conduits, as well as the plant design capacity, are due to the fact that combined sewers serve the city.

The plant is designed for operation with a minimum staff. It is contemplated that only 18 men will be required. Digester gas is expected to furnish power for most plant operational functions.

The cycle of operation begins with delivery to the plant of the sewage from the three 66-inch siphons passing under the arm of the Fraser River. The entering sewage will be prechlorinated and then passed to the pump building where it will be screened and the screenings ground. Six variable speed pumps will then lift the sewage about 30 ft. to the grit chambers. The six channels for grit removal are each 100 ft. long and 12 to 14 ft. wide. After washing, the grit will be airlifted and elevated to a hopper whence it will be trucked to a fill area. Following the grit chambers are five pre-aeration tanks which discharge to five sedimentation tanks. These latter are each 38 ft. wide and 215 ft. long, with a retention period of about 1½ hours.

Sludge from the sedimentation tanks will be air-lifted to sludge pumps which will discharge to two digestion tanks, 80 ft. in diameter

and 35 ft. deep, with floating covers. Heating of the sludge will be provided by recirculation pumps using waste heat from the gas engines. There are six gas engines, which can be operated on diesel fuel, if gas volume is insufficient. Each engine can generate 600 kw.

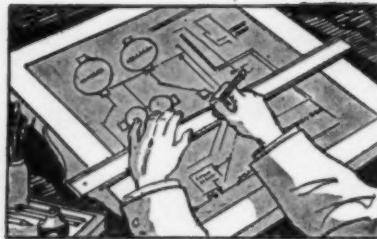
Digested sludge disposal is accomplished by pumping to four sludge lagoons, covering 25 acres, which are expected to care for the sludge produced during the next 20 years. In addition, there is space on the 200-acre island for additional lagoons.

Design of the project was by Brown and Caldwell of San Francisco, Calif., and Crippen Wright Engrg. Ltd., of Vancouver. Ken Patrick is chief engineer of the Sewerage District and T. V. Berry is Commissioner. Dave Keil is project engineer. Contractors include Tide Bay Dredging Co., Ltd., for earthmoving and outfall construction; Orenda Industrial Ltd. for the engines and generators; Babcock-Wilcox and Goldie-McCulloch Ltd. for the electric pumping units; and Quadra Construction Co., Ltd., for a wharf.

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(Continued from page 84)

with a normal use of 8 gals. per hour per person.

From California, 16 cities reported, most of them with peaks in the early evening. Average hourly use was 10.9 gals. per person; average peak use was 26.2 gals. High figures for peak hour use were: Arcadia 32.5 gals.; Burbank 40 gals.; Palm Springs, with 2000 swimming pools, 44 gals.; Pasadena 32 gals.; Sacramento 32.5 gals.; and Southgate 35 gals. Average consumption per person per hour ranged from 6.5 gals. per person per hour at Santa Cruz up to very high figures for Palm Springs and South Gate. In general, maximum hourly rates were 2½ to 4 times the average.

Three Connecticut cities reported average consumption at 4.67 gph per person and maximum consumption at 11.4 gals., with a range of 9.2 to 15 gals. per hour.

In Florida, Fort Lauderdale average use was 5.7 gals. against a peak of 23.6 gals. per person per hour for the period 4 to 6 PM. Other Florida cities reported no unusual peak demands. Five cities in Illinois, with an average hourly use of 5 gals. per person reported an average peak hourly use of 19.2 gals. The suburban cities of Lake Forest and Winnetka, with a maxim of 30 and 20 gals. per person per hour were high.

In 13 cities in Indiana, Iowa, Kansas, Louisiana, Maine, Maryland and Massachusetts which furnished data peak hourly uses were 2.6 times the average, with only a few places exceeding this rate—Cedar Rapids, Ia., 3 times the hourly average; Emporia and Topeka, Kans., 3.3 and 3.5 times; Auburn, Me., 3.5; and Salisbury, Md., 4.7 times or 35 gals. per person per hour peak after 6 PM.

In Michigan, 10 cities had an average hourly use per capita of 6.6 gals., with a range from 4.3 to 10 gals. Peak hourly average was 21.6 gals. per person. Benton Harbor and Oak Park with 23 gals. evening peaks and St. Joseph with 53 gallons peaking at 10 to 12 AM were high.

Edina, Hibbing and St. Cloud, Minn., showed peak hourly rates of 41.3, 21.6 and 30 gals. per person. All five Minnesota cities had high peak rates, with a combined 24.4 gals. per hour against a normal use of 3.7 gals. In Montana, both Billings and Dillon show high evening rates—32 and 29.4 gals. per person per hour against average rates of 7 and

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4.6 gals. In Nebraska, five cities had an average hourly use of 5.4 gals. per person and a peak of 15.1 gals.

Las Vegas, Nev., with an average hourly use of 14 gals. per person and a peak evening use of 55 gals., had one of the highest rates reported. New York cities showed a peak rate of about twice the average. Normal ranges were reported from North Carolina. In Ohio, Indian Hill and Lorain showed peaks of 18 and 15 gals. per person per hour, both in the evening hours, against average usage of 8 and 2.3 gals.

Oregon, as with many western states, showed a high peak rate. For five cities, average hourly use was 7.9 gals. and peak use 28.1 gals. Eugene reported an evening hourly peak of 51.6 gals. per person and Medford a rate of 38.9 gals.

In Texas, average hourly use in 9 cities was reported at 7.6 gals. per person, and peak use at 22.2 gals. All peaks occurred in the morning hours. High hourly rates were Dallhart 30 gals., Gonzales 36 gals., Kerrville 25 gals. and Midland 21 gals.

Utah and Virginia showed no unusual rates, but in Washington, peak hourly rates as reported average 29.7 gals. per person against an average use of 11.1 gals. High hourly rates included Colfax 35 gals., Seattle 34 gals., Spokane 30 gals. and Tacoma 33 gals.

Six Wisconsin cities, with an average hourly usage of 6 gallons per person reported peaks, all in the early evening, 3.2 times higher. Jefferson at 19.2, Milwaukee at 16.8, Shorewood at 25 and Wauwatosa at 23 gals. per person per hour peak demand were high.

The 1960 questionnaire survey on current average water use indicated an hourly figure of 5.9 gallons per capita which agrees well with the foregoing figures. That reported for 1950 was 4.5; that predicted for 1970 was 6.6. The 1956 study reported in PUBLIC WORKS in December of that year gave as peak hourly usage, 10.8 gals. per cap. in 1936, 12.8 gals. in 1946, 15.9 gals. in 1956, 17.8 gals. in 1966 and 19.0 gals. in 1976. The 1956 and 1966 figures agree fairly closely with the study reported here.

• • •

The Long Way Around

Truck drivers in the recent National Road Test near Ottawa, Ill., piled up an aggregate mileage of 17,124,122 miles, equal to 683 trips around the earth. Five pavement loops undergoing the tests were built of concrete and asphalt materials in 157 different designs.

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EQUIPMENT NEWS

Hydraulic Spreader



This hydraulic spreader can be used to spread either before or behind the carrier's rear wheels without reversing the hopper. The Shunk-Torwel combination front and rear spreader is an all-purpose, year-round unit requiring no adaptations or attachments for seal coating in summer or spreading for snow and ice control in winter. Dual 14" spinners located in front of the rear wheels are combined with a single 18" spinner at the rear. Spinners are hydraulically actuated by a selector valve in the cab. Front and rear spinner units operate inde-

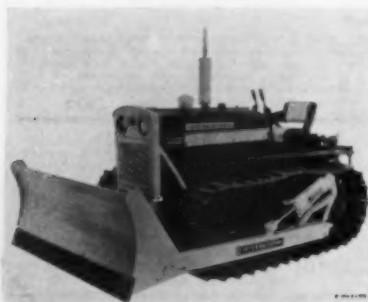
pendently and are controlled by merely flipping the selector valve. This changeover, heretofore impossible without reversing the entire hopper on the truck bed, can be accomplished "on the go." It is not even necessary to slow the truck down. All deflectors are interchangeable for simplified parts inventory. The position of any deflector, front or rear or either side, makes possible any spread pattern.

Shunk Manufacturing Co., Inc., Bucyrus, Ohio.

Circle No. 8-1 on the convenient reply card facing page 34.

Dozer Blade

A high-lifting, all-welded straight dozer blade, which lifts to 48 inches and drops to 11 inches, is available for T-340 and TD-340 crawler



tractors. This wide range of vertical operation makes the International No. 600 dozer blade equally useful for ditch or pond-dozing or log stacking. Making it possible to utilize the power and weight of the crawler is a 3½" x 12" hydraulic cylinder with piping that can be installed either over or under the tracks to suit operating conditions. Another advantage is the moldboard of long wearing steel which is curved to give a plow-like "roll" to the earth.

International Harvester Co., 180 North Michigan Ave., Chicago 1, Illinois.

Circle No. 8-2 on the convenient reply card facing page 34.

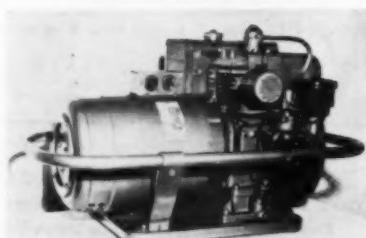
Pipe Pack

Palletized clay pipe, known as "Logan Pack," is a palletized unit of individual clay pipe lengths, resting on wooden skids, held together by steel bands and separated by special dividers. Several pipes are palletized into a single unit at the factory, which is loaded by regular fork trucks. During the transport each unit remains independent and rigid, firmly seated on the truck bed by its own weight. Sliding and shifting are eliminated. In addition to ease of handling and convenience in transportation, this handling method offers many advantages in sewer construction and considerable savings in labor and installation time during the actual construction work.

Logan Clay Products Co., Logan, Ohio.

Circle No. 8-3 on the convenient reply card facing page 34.

Portable Generators

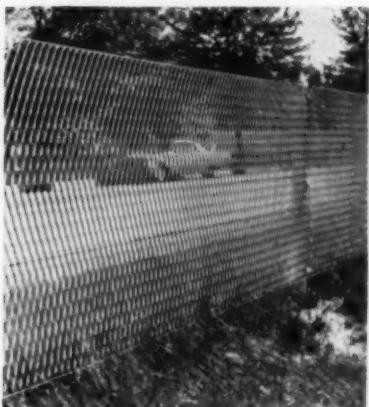


A series in sizes of 1000, 2000, 3000 and 4000 watts, AC, 3600 rpm, these portable engine-generators feature Briggs & Stratton engines, pull starter, protective carrying frame, rubber mounts and handy receptacles, with optional wheel dollies and housing also available. 1800 rpm series is also available with sizes starting at 750 watts and up for electric, remote, demand starting and automatic transfer arrangements.

Katolight Corporation, Box 891, Mankato, Minn.

Circle No. 8-4 on the convenient reply card facing page 34.

Glare Screen



Designed to eliminate the hazard of blinding headlight glare on divided highways, Alcoa glare screen is installed in the median strip of heavily traveled main roads. It consists of a four-foot high fence of aluminum expanded metal mesh, which effectively blocks out light from oncoming vehicles. It reduces nighttime danger on curves and on straight-away stretches with narrow median strips. The Alcoa screen needs no painting and is virtually maintenance free. Although it blocks direct headlight glare, the screen allows an almost unimpeded vision of the surrounding countryside, when viewed at an angle of about 90 degrees. It has a life expectancy exceeding 40 years, and is easily erected and transported.

Aluminum Company of America, 794 Alcoa Building, Pittsburgh 19, Pa.

Circle No. 8-5 on the convenient reply card facing page 34.

Self-Priming Pump

This 2" "Lightweight Line" self-priming contractor's pump stresses compactness and ease of portability from one job to another. This model has a feature that allows in-the-field conversion from general pumping to special application pumping with nothing to change. The priming operation is controlled by natural hydraulic action. One piece aluminum casings are used to avoid leakage in internal joints or gaskets. The pumps are available on steel skid base or semi-pneumatic tires.

Essick Manufacturing Co., 1950 Santa Fe Ave., Los Angeles 21, Calif.

Circle No. 8-6 on the convenient reply card facing page 34.

Platform Truck

This platform truck body, Daybrook Series 706-4 for dump use, is built for use by contractors and municipalities and in agricultural operations. The body is available in two standard lengths, 12'6" and 14'6". Standard width is 7' 11 $\frac{3}{4}$ ". Several dump hoists can be coupled to the unit, including the Daybrook 77-D Hi-Lift hoist. Equipped with the latter, the 706-4 can elevate a 12,000-lb. load to a height of 13 feet above ground for special applications. Floor of the body is 8-gauge steel sheet. Standard equipment includes four recessed ICC corner lights, four 1 $\frac{3}{4}$ -inch by 3 $\frac{3}{8}$ -inch



stake pockets at the front and back of the bed, and seven stake pockets on each side. Usable bed length with the stakes in place is 12' 1 $\frac{1}{2}$ " or 14' 1 $\frac{1}{2}$ ". Weight of the body is 1070 lbs. in the shorter version and 1240 lbs. in the extended version.

Equipment Division, Young Spring & Wire Corporation, Bowling Green, Ohio.

Circle No. 8-7 on the convenient reply card facing page 34.

Fire Fighter

A dry chemical extinguishing agent, called Foray, effective on Class A, B and C fires, is a multi-purpose dry chemical offered in any one of three sizes in either cartridge or stored pressure type extinguishers. Conversion kits will adapt most Ansul hand portable extinguishers now in service to the use of Foray dry chemical.

Ansul Chemical Company, Marinette, Wisconsin.

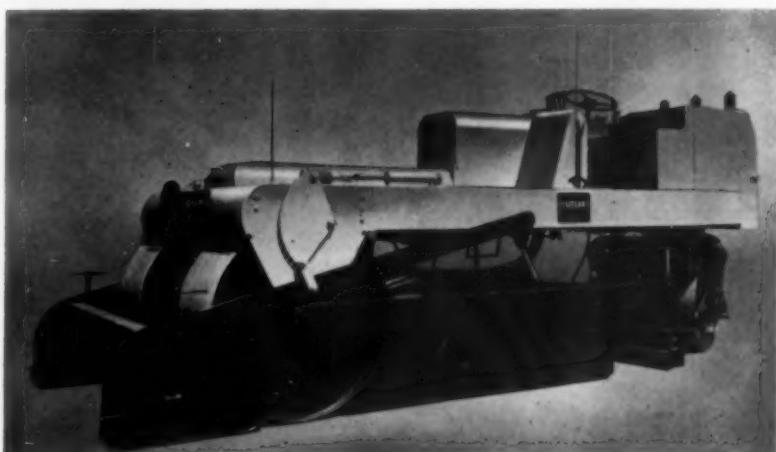
Circle No. 8-8 on the convenient reply card facing page 34.

Asphalt Repaver

The Model 84 Repaver has a working width of 84 inches and can work right up to the curb. The Repaver is low and wide with a design that gives the operator complete visual control at all times. Automotive power steering using an automotive steering wheel gives the operator precise control over the entire operation. Nickel iron grids channel the heat to the pavement and compact the existing remolded mix. The compaction rollers are heated with LP burners. The steering roller uses a stainless steel heating hood. Heated compaction provides 300 lbs. per lineal inch of roller width. A new asphalt mat can be laid at rates of 50 lbs. per square yard. The Repaver is powered by a Continental 226 cubic inch, 6 cylinder water cooled gasoline engine. The unit can repave from 500-600 square yards per hour.

Cutler Engineering Co., Div. of Asphalt Equipment and Engineering Co., 5435 W. 63rd St., Chicago 38, Illinois.

Circle No. 8-9 on the convenient reply card facing page 34.



Backhoe Bucket

Open on both ends for digging in either direction, the Kash bucket fits all popular makes and serves as backhoe, shovel and mud pawl, bell holer, and sand bucket. The all-welded steel bucket is available in 12, 16, 18, 24, 30 and 36-in. models. Capacities range from 4 cu. ft. with the 12-in. bucket to more than $\frac{1}{2}$ yard with the 36-inch model. Ends are tipped with replaceable H & L teeth. The bucket adapts to hydraulic backhoes of Ford, Case, International, Henry, Davis, John Deere, Oliver and others. Models for such larger makes as Bantam, Hopto and Gradall also are available.

Kash Products, Inc., 1980 Lake St., Huntington Beach, Calif.

Circle No. 8-10 on the convenient reply card facing page 34.

Post Hole Digger



The 38-pound Porta-Hole is powered by a $2\frac{1}{2}$ -hp, air-cooled, gas engine with recoil starter. The engine drive shaft transmits torque to a phosphorous-bronze worm gear—a total reduction of 22:1 including gear and belt reductions. The auger is fabricated from hot-roll, heat-treated steel. Replaceable cutting blades are also a feature. Trigger-type throttle control is an incorporated safety feature guarding the operator against machine run-away. It automatically stops the auger when released.

Cross Manufacturing Co., Lewis, Kansas.

Circle No. 8-11 on the convenient reply card facing page 34.



Floor Grating

Specially designed for strength, this close mesh grating retains a high degree of visibility and ventilation and is easy to maintain. Load-bearing capacity has been increased through use of 36 bars in each standard two-foot width. Clear opening is $\frac{1}{2}$ inch. Grating is also available with 37 bars in each two-foot wide panel ($\frac{3}{8}$ inch opening between bearing bars); and in other, minimum bar sizes. In addition to the strength acquired through closer mesh of bars, the grating is fabricated through an electroforging process. This provides one-piece construction of the bearing bars, and cross bars which are twisted to provide a slightly rough non-slip surface. Available in lengths of 20 feet or more, the new grating may be obtained galvanized, with standard paint or finished with an epoxy paint process resistant to wear, abrasion, corrosion, chemicals, and weathering.

Blaw-Knox Company, 300 Sixth Ave., Pittsburgh 22, Pa.

Circle No. 8-12 on the convenient reply card facing page 34.

Trench Backfiller

This auger backfiller is a multi-purpose machine with road speeds up to 30 miles per hour and backfill speeds from 0 to 2 miles per hour. A hydrostatic transmission controlled by a single valve gives forward or reverse speed. A ditch blinding attachment permits putting soil from 3 inches deep to complete filling of the trench, if desired. The unit has power steering and compact unit construction.

Anchor Sales Corporation 1109 Shimp Drive, Celina, Ohio.

Circle No. 8-13 on the convenient reply card facing page 34.

Plastic-Lined Cooler

Four plastic-lined coolers are available in 2, 3, 5 and 10-gal. sizes for either hot or cold liquids. A galvanized steel, corrugated outer wall is used for the coolers. Urethane foam has been applied inside as wall insulation. A seamless plastic liner to hold the liquid is inserted in the cooler. This polyethylene liner, which offers sanitation, freedom from taste and odors and high temperature resistance, is replaceable. A recessed spigot is also made of molded plastic.

Horton Products, Inc., P.O. Box 7156, Memphis 18, Tennessee.

Circle No. 8-14 on the convenient reply card facing page 34.

Comminutor



The Model 4R comminutor with two-way cutting is a reverse rotation comminutor that performs continuous screen cleaning and extends cutter and comb life. This comminutor is 25 ins. tall with a 4-inch drum. It has been designed especially for use in packaged sewage treatment plants, lift stations, marine installations, etc. Odor-free, nuisance-free and trouble-free, the Model 4R comminutor applies wherever the cutting and screening of waterborne sewage solids is essential to proper sanitary treatment.

The unit is easily handled by one man and is designed for flows of 15,000 gallons in 8 hours to 30,000 gallons in 24 hours.

Chicago Pump, 622 West Diversey Parkway, Chicago 14, Ill.

Circle No. 8-15 on the convenient reply card facing page 34.

Pusher Dozer



This addition to the "Paydozer" line of rubber-tired pusher-dozers, the Model D-500, weighs in excess of 100,000 lbs. One unusual feature is the full hydraulic-articulated steering which provides maneuverability. The turning radius of this unit is 25', less than its overall length and one-third less than that of a comparable rear-steer, rubber-tired unit.

The D-500 is powered by a 700 hp. turbo-charged, V-12 Cummins diesel engine, reduced to 600 hp. at 2100 rpm for longer life and lower maintenance. Two dry-type air cleaners are used to protect the

engine from airborne impurities. Added engine protection is achieved through filtration of all the oil circuits. The transmission is a full-reversing, constant-mesh type with speed ranges up to 15 mph in both forward and reverse. The pusher-dozer is equipped with a blade 160" wide which extends 10" beyond each side of the wheel path. The six-way hydraulic blade control permits lifting and lowering; side-to-side tilt.

The Frank G. Hough Co., 761 Seventh Street, Libertyville, Ill.

Circle No. 8-16 on the convenient reply card facing page 34.

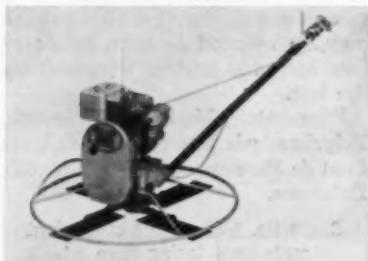
Power Trowel

A 36" power trowel with a choice of 3 or 6 hp. gas engines and 3 or 4 blades, this machine has a de-clutching mechanism which makes engagement of the blades easy and gives the operator complete control over the blade operation. A unique feature is that the handle of the trowel adjusts to the height desired by the operator.

The stationary guard ring allows operation of the power trowel close to sidewalls and baseboards without bounce back.

Muller Machinery Co., Metuchen, New Jersey.

Circle No. 8-18 on the convenient reply card facing page 34.



Pavement Sweeper



This Saganaw sweeper is built on a Dodge D-400 chassis. Every control for its completely hydraulic operation is located in the cab. It can turn within a 15-foot radius. It has a 4-yard rear-dumping hopper, carries 265 gallons of water for atomized spraying, can sweep at 1½ miles per hour and get to or from the job at 55 mph. The unit has 60 percent fewer working parts than earlier models—which means less down-time for repair.

Universal Metal Fabricators, Inc., Saganaw, Michigan.

Circle No. 8-17 on the convenient reply card facing page 34.

Chlorinator

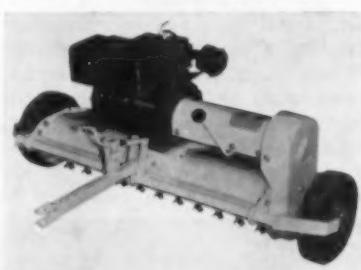
A compact chlorinator, the Advance 200 series, which feeds up to 50 lbs. in 24 hours in three ranges, is applicable for small water and sewage treatment installations. The standard system is vacuum operated solution feed with spring opposed diaphragm regulators and check valves. The chlorinator can be connected directly to the chlorine cylinder. A double-action inlet valve operates in one direction to regulate and reduce pressure and as a bubble-tight safety shut-off valve. In the other direction it seals the system under vacuum when the gas supply is exhausted or shut off.

A supply indicator flags with a red signal when the chlorine supply is shut off or exhausted, eliminating need for a chlorine pressure gauge, chemical protector and high pressure piping. Flow rate adjustment is manual with a single rate valve.

Capital Controls Company, Inc., Department M-19, Jones Ave, West Point, Pennsylvania.

Circle No. 8-19 on the convenient reply card facing page 34.

Hammer-Knife Mower

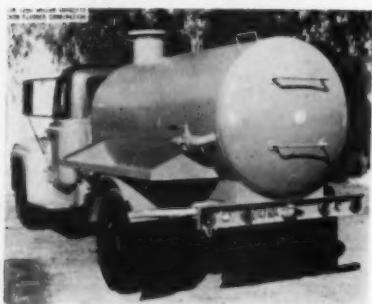


The 32" Mott hammer-knife mower is available in three models: Tractor powered front model, self-powered front model and self-powered trailer type. The trailer type unit can be ganged for wider cutting swath. It has a 5½-hp, 4-cycle engine and can be used with any small riding tractor. The 88 lightweight free-swinging blades fold back from obstructions and return to cutting position when clear.

Mott Corporation, 500 Shawmut Ave., P. O. Box 278, La Grange, Illinois.

Circle No. 8-20 on the convenient reply card facing page 34.

Mobile Tank



A truck-mounted vacuum tank for the removal or sprinkling of liquids, is available in capacities from 1250 to 2500 gallons. It sucks up water or liquid wastes, hauls the load away, and ejects it. The Klein mobile vacuum tank attains a vacuum for siphoning applications of 29" mercury at sea level, ample for municipal clean-up operations such as siphoning out storm drains, removing water from low spots or street overflows and pumping sew-

ers. In addition, the tank can be used as a street sprinkler or for wetting down construction projects. It throws a 16-foot wide spray at the rate of 400 gallons per minute.

Klein Welding Service, Inc., 14618 E. Arrow Highway, Baldwin Park 43, California.

Circle No. 8-21 on the convenient reply card facing page 34.

sired by local, state or federal regulatory agencies. The flashers are equipped with choice of red or amber puncture-resistant plastic lenses. Inexpensive bulbs are used instead of costly fluorescent tubes.

Electronics Division of Barler, Inc., 214 West Jefferson St., Goshen, Ind.

Circle No. 8-23 on the convenient reply card facing page 34.

Barricade

Horse-type barricades with the Blink - N - Beacon transistorized warning flasher lights have a minimum battery life of 1,500 hours. Operating on standard 6-volt dry cell batteries, the barricade flashers can be seen from either direction for a half mile in the most extreme weather conditions—snow, sleet, rain, fog—and much longer distances under normal conditions. Flashing rate is a uniform 50 to 60 a minute, or at any other rate de-



Crushing Plants

This new series of tandem crushing plants will include the Pitmaster Commander, Models 111 and 211; Junior Commander, Models 322, 332, 422 and 432; Senior Commander, Models 443 and 543; Super Commander, Models 555 and 645; and the Master Commander, Models 557, 657 and 667. The Super and Master plants will be available with either mechanical or semi-electric drives. A line of optional accessory equipment, such as a pre-screening attachment, washing equipment and sand ejectors are available. These models offer a choice of crusher sizes which may be combined to

meet specific crushing conditions and product specifications, such as high percentages of pit run oversize, the need for greater secondary crushing capacity, etc. Up to six screen-deck arrangements are possible to produce from 1 to 4 products simultaneously. Tonnage output of the plants in the Commander Series, when producing minus 1" material, ranges from the Pitmaster's 75 tons per hour to the Master's 700 tons per hour.

Iowa Manufacturing Co., Cedar Rapids, Iowa.

Circle No. 8-22 on the convenient reply card facing page 34.

Riding Mower

Designed for rugged, hard use, the Pennington "Big 60" mower provides maximum operator comfort and efficient operation for heavy-duty full-time lawn maintenance assignments. Designed for large estate, industrial, municipality or farm lawn maintenance, the three high-speed cutting blades trim close, even and smooth over a full 59-inch wide cutting path.

Pennington Manufacturing Co., 60 Mower Division, Addison, Ill.

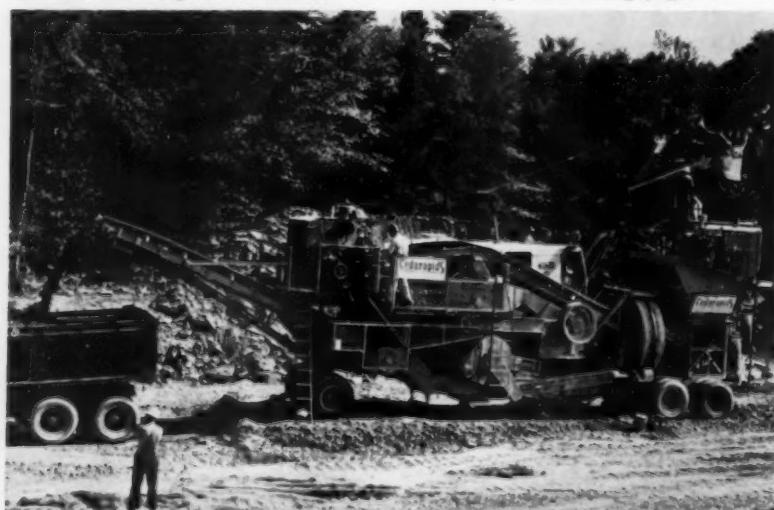
Circle No. 8-24 on the convenient reply card facing page 34.

Broom Filament

The "Herox" I-beam cross section broom filament gives the greatest stiffness per volume of material and causes the filaments to cut and scoop up dirt. New brooms of Herox, set at a six-inch pressure pattern, will pick up even the heaviest dirt or debris. Later, when the broom is half-worn, the pressure pattern may be reduced to four inches or less. Herox is packed 50 pounds to the box.

Filaments Marketing Section, Polychemicals Department, E. I. du Pont de Nemours & Co., Wilmington, Delaware.

Circle No. 8-25 on the convenient reply card facing page 34.



Sump Pump

This air-operated sump pump, easily carried by one man, can be operated on a moderately low volume of air supplied by a small portable compressor. The new 225 sump pump, designed primarily for contractors and utility maintenance crews, handles clear or dirty water, oil, sewage, or light sludge. Applications include pumping out manholes, cellar excavations, ditches and holes for utility poles. This pump is only $16\frac{1}{4}$ " high including air strainer and weighs $33\frac{3}{4}$ lbs.



The rated water delivery at 90 psi is from 197 gpm at 10 ft. head, to 68 gpm with an 80 ft. head. Powered by a governed Multi-Vane motor.

Ingersoll - Rand Company, 11 Broadway, New York 4, N. Y.

Circle No. 8-26 on the convenient reply card facing page 34.

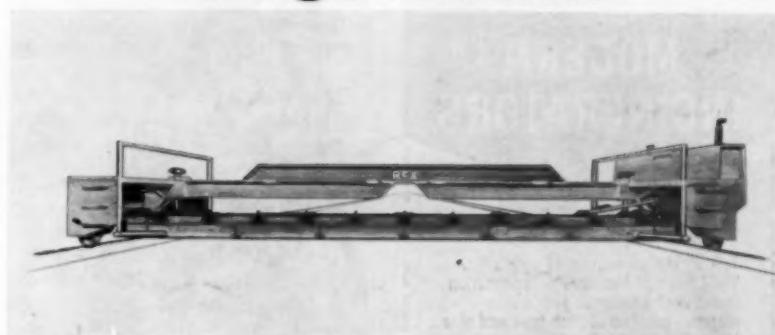
Plow Bolts

This line of heat-treated plow bolts for fastening grader and other blades, have thick heads and are double heat-treated for high tensile strength. Quality control insures that these plow bolts conform to the highest grade specified by S.A.E.—more than 150,000 psi tensile strength. The design of Paclal plow bolts includes full square corners on the shank to prevent turning.

Paper, Calmenson & Company, St. Paul 13, Minn.

Circle No. 8-27 on the convenient reply card facing page 34.

Bridge Finisher



This light-weight, self-propelled, concrete bridge deck finisher provides economical and accurate mechanical finishing—especially on short bridge projects; eliminates deflection problems and provides bridge deck surfaces that are as smooth as road surfaces. The machine includes a light-weight screed and non-telescoping, "T" beam frame. Its standard-size screed is 23 feet and is equipped with two sets of extensions built to customer specifications. Additional screeds are available for conversion to

larger or smaller size ranges. A standard manual crown screed with a 12-inch-wide bottom is furnished, with an optional, double 12-inch manual screed or 16-inch-wide bottom quick crown screed. Each finisher is equipped with a standard 15-hp engine which is located with hydraulic pumps, screed transmission, etc., in an end truck section.

Chain Belt Company, Construction Machinery Section, Milwaukee 1, Wisconsin.

Circle No. 8-28 on the convenient reply card facing page 34.

Pipe Puller

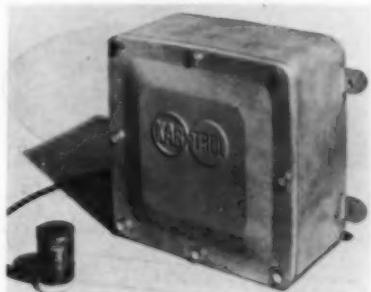
The heavy duty Pow-r Mole was designed and developed to push rods under any condition where pushing is possible and to pull $\frac{1}{2}$ " to $3\frac{1}{2}$ " diameter copper, steel or plastic pipe or tubing underground. It attaches to most standard tractor-mounted hydraulic back hoes. One man can dig the trenches, attach and set up the unit, insert the rod sections and operate the tractor hydraulics. The unit comes complete with full set of cribbing, 50-ft. push rod and pusher cap. By utilizing the furnished cribbing, the unit remains fixed in position throughout operation.

Pow-r Devices, Inc., Clarence Center Road, Clarence Center, New York.

Circle No. 8-29 on the convenient reply card facing page 34.



Ice Detector



This system consists of two warning signs, a cabinet housing control equipment and two sensing elements. The elements sense freezing temperature and moisture on the pavement surface or bridge deck and activate controls causing the warning sign to display an illuminated message. Can be installed to detect and warn of wet surfaces as well as of ice, snow or frost. The temperature sensing element is housed in an aluminum case and hermetically sealed. It is accurate to within $\frac{1}{2}$ F and suitable for burying in the roadway surface. The moisture sensing element is made of stainless steel and other non-corrosive materials.

Kar-Trol Signal Co., Inc., 12739 South Main St., Houston 35, Texas.

Circle No. 8-30 on the convenient reply card facing page 34.

Modern Waste Disposal DEMANDS **MODERN INCINERATORS**

You tell us—
We'll tell you—

Tell us the population of your area. We'll tell you frankly why incineration is the best answer to your waste disposal problem...the type and size incinerator needed...approximate construction and operating costs. No obligation.



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APCO SUPER-DeLAVAUD
CAST IRON PIPE
WITH ALTITE® JOINTS

meets ALL 10 requirements
for underground mains

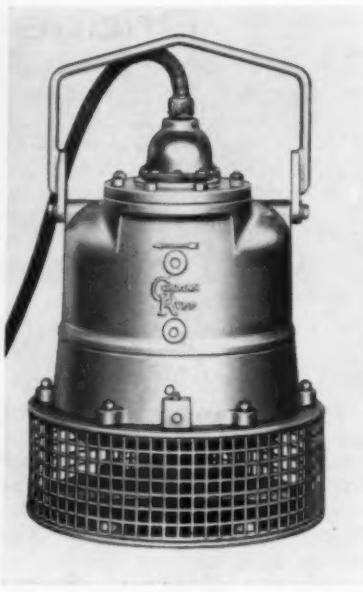
- Service for centuries
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- High record of maintained flow efficiency
- Strength against crushing
- Strength against impact
- Beam strength
- Strength against internal pressure
- Impervious pipe walls
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**NO cheap substitute pipe
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DETROIT: 18505 W. Eight Mile Road
SOUTH GATE, Calif.: 5335 Southern Ave.
SAN FRANCISCO, Calif.
ORLANDO, Florida



Dewatering Pump

An 8-inch submersible dewatering pump, Model S8A1, ranges from 1000 GPM at 148' head to 2700 GPM at 40' head. It has an oil-filled motor housing for increased cooling and dual seals that run in oil. Height is 31", diameter 28". Aluminum construction reduces weight to 775 lbs. Strainer area is 480 square inches with 1" square openings. The 8-inch submersible is available with 65 hp motor, 1750 RPM, 3 phase, 60-cycle, 220 or 440-volt current. Fifty feet of cable are provided with each unit.

The Gorman-Rupp Co., 305 Bowman St., Mansfield, Ohio.

Circle No. 8-31 on the convenient reply card facing page 34.

Wheel Tractors

Three heavy industrial wheel tractors, Oliver Model 1800 gas and diesel and Model 1900 diesel, have maximum drawbar pull range of 10,619 to 12,475 pounds and horsepower range of 80.5 to 102. Designed



for construction, municipal and utility market applications, the tractors have six speeds forward and two reverse. Speed range is 1.59 to 14.30 mph forward, 1.8 to 4.84 mph reverse. Equipment includes dual headlights, tail-lamp and rear flood, industrial type rear wheel guards, differential triple disc brakes, and 12-volt battery with safety starting. Model 1900 is equipped with 14-inch dry single plate clutch; the 1800 models with 13-inch dry single plate, for rough construction-type operations. Power steering and rear PTO are available as extras.

Oliver Corporation, 400 W. Madison St., Chicago 6, Ill.

Circle No. 8-32 on the convenient reply card facing page 34.

Gyratory Tester



A gyratory testing machine, available from Soiltest, Inc., is a combination compaction and testing machine for use on base course materials, soils and bituminous mixtures. It is designed for use by road and highway departments, materials producers and suppliers, testing laboratories, consulting engineers, colleges and universities, aggregate producers and research organizations. The machine produces test specimens by a kneading compaction process since specimens prepared by this process are more reliable for use in laboratory strength and consolidation tests.

Soiltest, Inc., 4711 W. North Ave., Chicago 39, Ill.

Circle No. 8-33 on the convenient reply card facing page 34.



FILMS in Brief

Listed below are motion picture films of current interest to engineers, administrators and supervisors in the public works field. The companies providing these films have indicated that the films are available for appropriate use by PUBLIC WORKS readers. Requests for films should be made direct to the company listed with the film.

"Bio-Pac—Big City Sewage Processing for Small Capacity Needs." Single unit sewage treatment system shown. (10 min., color, sound, 16 mm.) Link-Belt Co., Dept. PR, Prudential Plaza, Chicago 1, Illinois.

"Build With Steel." The story of the fabrication and erection of structural steel. (25 min., color, sound, 16 mm.) Department of Educational Services, American Institute of Steel Construction, Inc., 101 Park Avenue, New York 17, N. Y.

"Sewage Treatment." Aerobic digestion treatment process operation of the Oxigest sewage treatment plant. (16 min., color, sound, 16 mm.) Smith & Loveless Division, Union Tank Car Co., Lenexa, Kansas.

"Flintseal." Cleaning old pavement joints and sealing with material meeting Federal specifications. (20 min., color, sound, 16 mm.) Paving Products Section, The Flintkote Co., P. O. Box 157, Whippley, New Jersey.

"Standard Laboratory Control of Soil-Cement Mixtures." Standard ASTM-AASHO laboratory procedures for testing soil-cement. (color, sound, 16 mm.) Portland Cement Association, 33 West Grand Avenue, Chicago, 10, Illinois.

"Send the Pelican." Applications and demonstration of fiberglass aerial personnel bucket. Pitman Manufacturing Company, P. O. Box 571, Grandview, Missouri.

"Stabilization Mixing Plants." Advantages of central plant stabilization with the many additives used. Publicity Department, Barber-Greene Company, Aurora, Illinois.

"Modern Water Treatment." (22 min., color, sound, 16 mm.) Inflico Inc., P. O. Box 5033, Tucson, Arizona.

"Ortho Fly Killer D." Documents an exhaustive study leading to the development of a potent new fly killer and shows application methods. California Chemical Company, Ortho Division, Richmond 4, California.

"New Concept For Paving." Demonstrates the operation of the Cedar Rapids Bituminous Paver. (24 min., color, sound.) Iowa Manufacturing Co., Cedar Rapids, Iowa.

"Clean Waters." Presents facts on America's waters, water pollution and sewage treatment. (30 min., color, sound, 16 mm.) Public Health Service, U. S. Department of Health, Education and Welfare, Washington 25, D. C.

"Water—Its Many Voices." Illustrates soil and water management in a total approach: handling soil and water problems on a nationwide or watershed basis. (22 min., color) Advertising Department, Allis-Chalmers Construction Machinery Division, Milwaukee 1, Wisconsin.



Scene from "Water—Its Many Voices."

CLASSIFIED

CITY ENGINEER

The City of Hamilton, Ohio, population 73,000 is recruiting for a professionally registered Civil Engineer with proven administrative ability. Must have proficient background in street and highway engineering and sanitary and storm sewer engineering. Age 30 to 55.

Position offers good salary and excellent fringe benefits. An excellent opportunity for a capable person. Send resume to:

Director of Civil Service
City of Hamilton
Hamilton, Ohio

Director of Public Works

A Director of Public Works is wanted by the City of Platteville, Wisconsin; 7,000 population; 20 employees (exclusive of education and police departments); mayor and 8 councilmen. Must be registered civil engineer; experience necessary; salary open; can assume duties after Nov. 1, 1961. Send application, qualifications, experience record and desired salary to:

L. C. Kindschi
City Clerk
Platteville, Wisconsin

EXECUTIVE SECRETARY

The City of Staunton, Va., situated in the heart of the Shenandoah Valley, population 23,000, needs the services of an Executive Secretary for a newly organized Redevelopment and Housing Authority. Urban Renewal experience necessary. Salary up to \$8000.00 based on experience.

Write to:
M. J. Reid, Chairman
City Hall
Staunton, Virginia

Available

Asst. Supt. of Water Dept.
Currently employed as Assistant Superintendent in city of 30,000. 34 years old, employed by water department 37 years. Seeking position in small town in New England as Superintendent or a position selling water works supplies in New England.

Write to:
Box 8-1
Public Works Magazine
200 South Broad Street
Ridgewood, New Jersey

Experienced Sales Engineer

A man experienced in sanitary engineering sales and sales supervision is available. Wide acquaintance with consulting and other engineers. Now located in the East and generally prefers Eastern location, but will move. Full details of experience and training and references from:

Box 8M
Public Works Magazine
200 South Broad Street
Ridgewood, New Jersey

Assistant City Engineer

City of Wadsworth, Ohio, population 10,600. Present salary \$5500-\$6000, fringe benefits. Graduate Civil Engineer with desire to accept responsibility. Apply to:

Leland M. Kraft, Service Dir.
City Hall
Wadsworth, Ohio

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WORTH SEEING

Community Relations portfolios of the Cast Iron Pipe Research Association provide tested plans to assist water utility and other public officials in arousing and sustaining interest in local water works improvement programs. Here the Association's managing director, Thomas F. Wolfe (seated, left), and assistant managing director Wallace T. Miller (left) check new copies with executives of Buchen Advertising, Inc.



Mules Lose Out. Four-wheel drive Topeka Highway mowers with oversize tires cut grass on steep embankments of the Dallas-Fort Worth Turnpike, replacing sure-footed mules pulling farm hay mowers that did the job through the 1960 season.



New Research Center of Lock Joint Pipe Company houses machine that can test strength of pipe up to 10'.



Quick-freeze helps build seaplane base on Minnesota lake. Three-inch slot sawed in the ice guides placement of Armco interlocking sheet piling. Piles are allowed to freeze in place and then driven to grade. Work was done for the U. S. Forestry Service.



Horses Make Gains. No automobile traffic rolls on this recently paved state highway which encircles Michigan's Mackinac Island. The eight-mile long, 12-foot wide autoless highway was paved to reduce high annual maintenance costs.

ATTENTION LANDSCAPE ARCHITECTS

NEW CHEMICAL CONCENTRATE ENDS REST AREA PRIVY ODORS!



Get Complete Proven
Success with
SANI-SEPTIC
CONCENTRATE
FORMULA—500—I. R. B.

Revolutionary new Sani-Septic Concentrate is a complete new approach to the problem of rest area odor control. The result of extensive research and development, Sani-Septic Concentrate destroys the bacteria that are the source of privy odors. Unlike other products, Sani-Septic is not a perfume or odor "cover-up." It leaves no odor of its own. Sani-Septic is a liquid that is diluted with water and poured into the privy vault. It destroys present odors and future odors. It is economical to use and is unconditionally guaranteed to provide the sanitation required. Test installations in the State of Ohio rest areas and roadside parks have proven the unique effectiveness of Sani-Septic Sanitation.

Why Sani-Septic Destroys Odor

Sani-Septic Concentrate completely ends odor where others fail because it controls the growth of the micro-organisms that produce sulphides with their strong unpleasant odors. In addition it prevents the growth of fungi that speeds decomposition of waste materials and resulting offensive odors.

Send for complete information.

**WERLEY CHEMICAL
& SUPPLY CO.**

1505 Broadway
Cleveland 15, Ohio



by Arthur K. Akers

★ Tentative agreement has been announced for purchase of the Lynchburg (Va.) Foundry Co. by Woodward Iron Co. of Birmingham. In 1959 Woodward acquired the Alabama Pipe Co., Anniston; also the cast iron soil pipe plant of the Western Foundry Co., Tyler, Texas. Lynchburg is known in this field as an important producer of cast iron pressure pipe and fittings.

★ C. M. Ritchey appointed director of advertising, merchandising and public relations, Willys Motors, Inc.

★ Armeo Drainage and Metal Products consolidates ten divisions, coast-to-coast, into three major areas. Headquarters will be Middletown, Ohio; Topeka, Kansas; and Denver, Colo., under James E. Kunkler, Alvin J. Mistler and William W. Mains, respectively.

★ Waukesha Motor Co. advances F. G. Schulze to vice-president of sales.

★ Bert F. Whitbread appointed vice president of Motec Industries, Inc., for Mobilift Materials Handling and Highway Equipment Divisions.

★ Badger Meter Mfg. Co. names Ralph E. Moon assistant sales manager, Water Meter Division at Milwaukee.

★ William R. Stalker joins Robert K. Hampton, to form Hampton Equipment Co., 50 Church St., New York, manufacturers agents in the public works field.

★ American Pipe Cleaning Co.'s new national headquarters building in St. Louis Park, Minn., is nearing completion, expanding its facilities for doing nationwide sewer and water main cleaning, TV pipe inspection, etc.

★ Martin C. Dwyer of Washington, D. C., is named CIMA's Road Show manager, for the great Exposition and Road Show to be held in Chicago beginning February 23, 1963.

★ Southern Pipe Div. of U. S. Industries, Azusa, Calif., appointed Edwin R. Breitman director of advertising and publicity. Charles F. Colesworthy is named general sales manager. Edward W. Connell is promoted to sales manager of water pipe and Robert D. Morrison advanced to manager of engineering services.

★ Hamilton Kent Mfg. Co., Kent, Ohio, names Louis K. Lukity to the post of technical superintendent.

★ Edward E. Brush elected executive vice-president of Soilttest, Inc., Chicago.

★ Kennedy's Van Brush Mfg. Co., goes into new and much larger quarters at 2748 McGee Trafficway in Kansas City. The firm is a large manufacturer of rotary broom sweepers and cores.

★ Lock Joint Pipe Co. opens its new \$600,000 Research and Development Center at Wharton, N. J. The Center has a staff of 60 scientists and engineers, and houses one of the world's largest machines for testing the bearing strength of concrete pipe. Lock Joint has also acquired the Oscar Davis Co., Paterson, N. J., as an addition to its Plastics Manufacturing Division.

★ Tar Products Div., Koppers Co., Inc., appoints John T. Tierney Jr. as sales manager of their Eastern Road Materials Department, at Albany, N. Y. Robert C. Kenan succeeds him as manager, Hot Applied Coatings Section, Chicago. R. Gordon Palmer is appointed sales manager, Koppers' new Highway Emulsions Department.

★ Dresser Mfg. Division opens a new warehouse in Los Angeles to serve Southern California and Arizona. Dresser has had a San Francisco headquarters for a number of years.

★ Good judgment comes from experience and experience comes from poor judgment.

—N. D. Coarse Screenings



... Since 1894

13,512

**HORTON ELEVATED STEEL
WATER STORAGE TANKS**



■ CB&I's experience in the design, fabrication and erection of elevated steel tanks for water storage is unmatched by anyone. In 1894, CB&I pioneered the first hemispherical bottom tank at Ft. Dodge, Iowa. With the recent erection of a 1,500,000-gallon Horton® Spheroidal for Wheaton, Illinois, CB&I's experience spans 13,512 elevated steel water storage tanks . . . and scores more are under construction. CB&I's sound experience and pioneering spirit can solve your water storage problems, too. Let us show you how.

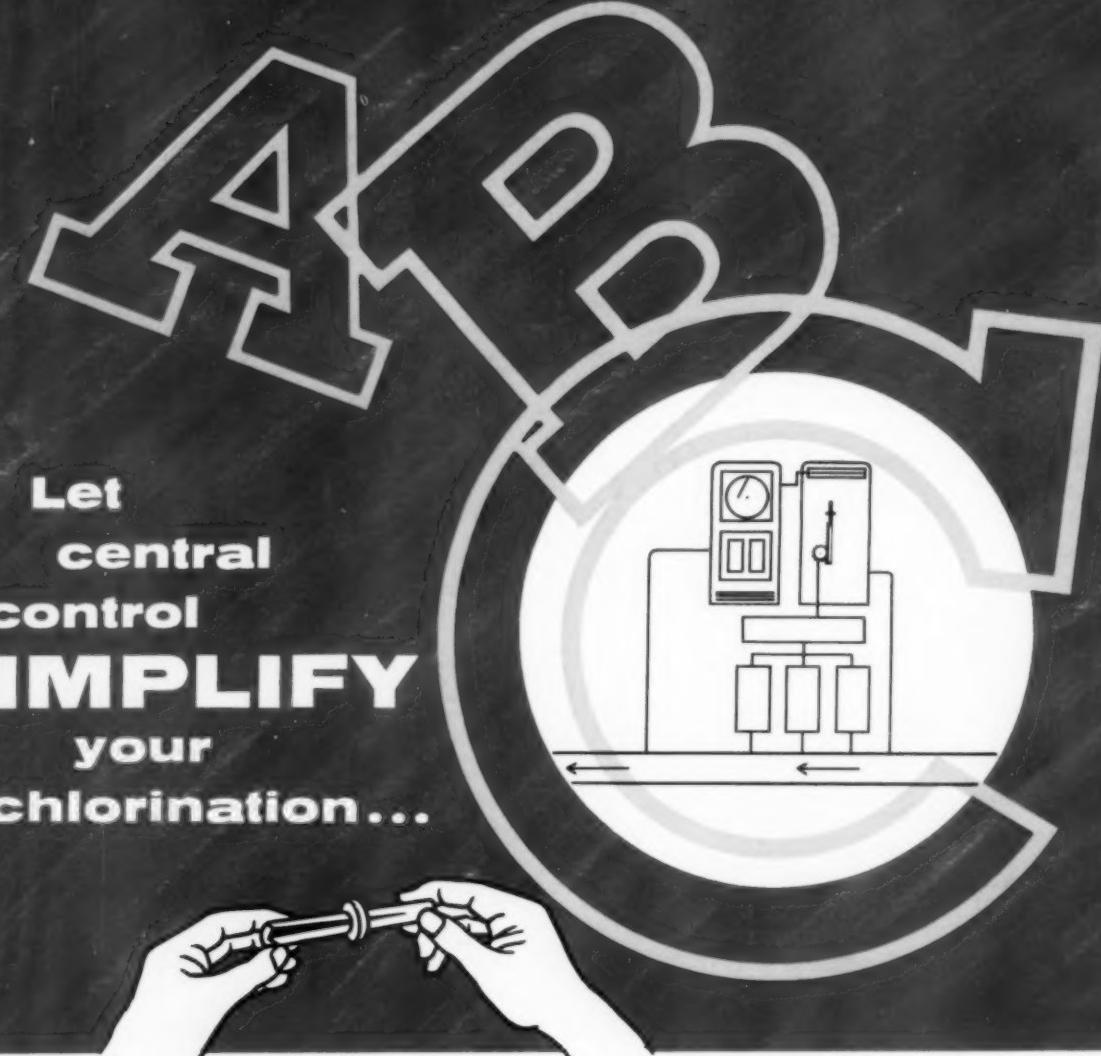
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control
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your
chlorination...

W&T

COMPOUND-LOOP CONTROL

By residual analysis and information feedback, Wallace & Tiernan Compound-loop Control adjusts chlorinator feed rates to changing water flows and chlorine demands. You can add W&T Remote Residual Recording and Controlling Components throughout your water system and centralize control at any desired location. You select the desired residual on a central panel and the Compound-loop System maintains that residual faithfully.

Remote recording by W&T gives you duplicate residual records and minute-to-minute information where it helps guide operation. Remote controlling by W&T lets you adjust a chlorinator miles away. And W&T Remote Components adapt to almost any system, any type of control.

With remote residual recording and controlling by Wallace & Tiernan you centralize control... save time and operating expense... extend the advantages of the Compound-loop method.

For more information, write Dept. S-142.78



WALLACE & TIERNAN INCORPORATED

25 MAIN STREET, BELLEVILLE 9, NEW JERSEY



